The Canadian Journal.

TORONTO, FEBRUARY, 1853.

INCORPORATED BY ROYAL CHARTER.

Memorial of the Canadian Institute to the three branches of the Legislature to continue the Royal Magnetic Observatory under Provincial Management.

To the Honorable the Legislative Council of the Province of Canada, in Parliament assembled.

The Memorial of the undersigned members of the Canadian Institute, Humbly Sheweth,—

That your Memorialists have heard with much regret that Her Majesty's Government has determined to withdraw the Detachment of the Royal Artillery at present employed in making Magnetical and Meteorological Observations at the Observatory at Toronto, and to maintain that establishment no longer.

That your Memorialists being members of a Society incorporated by Royal Charter, for the purpose of promoting the cultivation of scientific pursuits in Upper Canada, view with great concern, the discontinuance of the only observations made systematically and upon a large scale, on any class of natural phenomena, in British North America.

That as regards the science of Terrestrial Magnetism, your Memorialists believe that all which has yet been effected in that subject, has but opened the way, to wider and more general enquiries; that the period over which the observations at present extend, is much too short to have elucidated completely the various annual and secular changes which it has brought to light, and that a prolongation of those researches, more particularly, which have indicated a connection subsisting between the magnetic variations and the *solar spots*, and a secular period in both variations, is eminently recommended by their novelty and interest.

That your Memorialists believe that the discontinuance of the observations so long and so systematically made in every department of Meteorology at this establishment, will not only deprive all those interested in that difficult and intricate subject, of a centre of reference, of comparison, and of support, the local and immediate value of which is, perhaps, more generally felt, than that of any other class of observations, but will also cut off the possibility of a large class of highly important enquiries, more particularly those which relate to the gradual change of climate which Canada is supposed to be undergoing, to their influence upon Agriculture, and to the periodical recurrence of seasons marked by peculiar manifestations of disease, and other important practical characteristics; which require a long, unbroken, and strictly comparable series of observations for their solution.

That your Memorialists conceive that it will be a reproach to a country so populous as Canada, of so large a public revenue, and possessing a University so largely endowed, if it suffers an establishment to fall to the ground which is of confessed scientific importance, and in whose continuance scientific men in the United States and elsewhere have repeatedly expressed their warmest interest.

That your Memorialists believe that the time has rather come when its operations should be placed upon a less restricted basis, and be extended from the special objects for which it was originally founded; to make it a centre of reference for all that large class of pursuits which involve periodical phenomena; and to include those higher departments of science, and more particularly of Astronomy, to which every Canadian must aspire to see his country one day contribute.

Your Memorialists, therefore, pray that your Honourable Council, will be pleased to take such steps, as to your wisdom may seem best, to effect the farther continuance, by Provincial authority, of the Observatory heretofore conducted at the expense of the Imperial Government in Canada, after the withdrawal of the Military detachment; by placing it in connection with the Provincial University, or by maintaining it as an independent Provincial Establishment.

And your Memorialists, as in duty bound, will ever pray.

The following extracts from a correspondence printed by the Royal Society for the information of its members, in 1850, are interesting, in connection with the subject of the foregoing petition, and well calculated to assure the public that in placing the Observatory at Toronto upon a stable basis, the Government will only be carrying into effect what has been called for by men of the most eminent science in England and the United States. A country, whose public revenue approaches a million pounds currency, (£842,184, in 1851.) and whose enormous and costly public works attest at once the vigour of its resources, and the boldness with which it can be applied in measures of national importance, cannot be excused from bearing also a modest share in those burdens,—if they can be so called,—which a wise recognition of the claims of science has added, in almost every civilized land, to the necessary cost of civil administration or material developement. For what, after all, is Science? It is nothing but the investigation of those laws of nature and properties of matter, our acquaintance with which is the foundation of all national prosperity; and which, once mastered, enable us to subject the one, and bind the other, to our car of triumph. No country, capable of reciprocating the advantages she derives from others in this respect, can justly refrain from doing so.

There are other reasons why, at the pre[illegible] time, this colony should cordially accept the office to whic[illegible] called. In such an establishment as a national observatory, are the elements of the truest claims to national respect. Shall the British colonies acquiesce in the sentiment so often lurking in the minds of those with whom they have to deal in public or private relations; that a colony is by necessity a place of rude abundance indeed, and a liberty which trenches upon license, but where the refinements of life, the pleasures of the intellect, and the pursuits which lead to other distinction than that of wealth, can never be naturalized? To be respected abroad, we must respect ourselves, and seize with no timid or reluctant hand each occasion, as it arises, for displaying an enlarged and enlightened public feeling. We fancy that were the claims of the colonies to a perfect equality of social position with imperial Britain once cordially admitted, we should have much less of imaginary political grievances; but to attain this, we have to prove a right by measures which the consent of the civilized world receives as true indices of the advancement of a community. The observatory at Toronto may be obscure or distinguished,—a vigorous mainspring to a thousand scientific impulses,—or a mere machine for tracing a tame routine: this must depend upon its system and upon its head, and especially upon the measure of public liberality dealt to it. But what we contend for is, Canada deserves to have an observatory; can maintain, and can appreciate one. Its success, which time alone can test, and which no knowledge or ability at its head can render palpable to every one from the first, must be gained by degrees; nor will any delay in the production of scientific results of importance detract from the credit which will be justly due to the Canadian public for the formation and maintenance of such an establishment.

No. 1.

From Dr. Lloyd, President of the Royal Irish Academy, to the Earl of Rosse, P. R. S.

TRINITY COLLEGE, DUBLIN, Nov. 13th, 1850.

DEAR LORD ROSSE,—I have to acknowledge the receipt of your Lordship's letter, in which you do me the honour to ask my opinion on the question of the continuance of the Magnetical Observatory at Toronto.

I have long thought that the present state of some of the sciences connected with terrestrial physics demanded a *continuous* system of observation; and therefore the establishment of *permanent observatories* for their effective advancement: and I believe that I could easily cite, in support of this opinion, the authority of Humboldt, Herschel, Kupffer, and others.

I ventured to urge this view at the Magnetical Conference held at Cambridge a few years ago, under the auspices of the British Association; and I believe it was in the hope of carrying it out in this particular instance that it was resolved to recommend to Her Majesty's Government to continue the observatory at Toronto for a limited time, in the hope that before the close of the period arrangements might be made with some of the colonial institutions to take it up.

I am not aware what steps have been taken to carry out this object, or whether they have been taken and failed. Should the latter be the case, the question is of course altered; but, even in that case, I would venture to suggest the importance of the temporary continuance of the observatory on its present footing for some time longer, if it were only to carry out to its completion the trial of the self-registering of magnetical and meteorological instruments, by photographical processes, which has been instituted there on so large a scale.

The two methods which have been proposed for that purpose (and of which the importance has been recognized by Her Majesty's Government, by the bestowal of liberal pecuniary rewards), are both in operation at Toronto, and under the direction of Captain Lefroy, an officer who is able to give them the fullest trial, as well as to improve and perfect them, so that an experiment of great importance to physical science would probably be interrupted and lead to no conclusion if the observatory were now to be discontinued.

For these and other reasons I believe that it is desirable that an application should be made to Her Majesty's Governm[illegible], requesting them to direct the continuance of the Magnetical Observatory at Toronto for some time longer, in case that none of the local institutions are in a condition to undertake its management.

I remain, dear Lord Rosse, yours very faithfully,

The Earl of Rosse, &c. H. LLOYD.

No. 2.

From Sir John Herschel, Bart., to the Earl of Rosse, P.R.S.

32, HARLEY STREET, Dec. 28th, 1850.

MY DEAR LORD ROSSE,—I entirely agree in the view taken by Dr. Lloyd, relative to the Toronto Observatory. It has become, from the fine series of observations already made there, a local centre of reference for the magnetic and meteorological observations of the whole of Canada and Northern America, of the greatest importance. If continued, whether under the Canadian Government alone, or aided by the Home Government, it would become the national observatory, the centre of diffusion of astronomical and of all exact scientific enquiry, and the zero point of a future trigonometrical survey.

If only temporarily continued, the working out of the recently adopted methods of photographic registry would form a very valuable contribution to the progress of those new methods which promise to supersede all others, both in point of exactness and economy; and *I think it would be very desirable*, if so continued, that some attempt should be made, pendente, to influence the colonial authorities definitively to take it up. Perhaps this might be done, on condition of another three years' continuance: I mean that it might be granted, provided a pledge could be obtained from the colonial authorities that it should afterwards be a colonial establishment.

I remain, my dear Lord, yours very truly,

J. F. W. HERSCHEL.

No. 3.

From the American Academy of Arts and Sciences to the Earl of Rosse, P.R.S.

CAMBRIDGE, U. S., Nov. 25th, 1850.

MY LORD,—The undersigned, a committee of the American Academy of Arts and Sciences, have been directed to address your Lordship on the subject of continuing the meteorological and magnetical observations at Toronto, in Upper Canada.

The Academy has been led more particularly to take this step in consequence of the organization of a uniform system of *meteorological observations in the United States, under the* auspices of the Smithsonian Institution. Thirty-seven stations have been established in the State of New York, and twelve in the State of Massachusetts, under the superintendence of one of the committee (Professor Guyot) and are now in successful operation. It is unnecessary to say that this arrangement furnishes very important means of comparison with the observations made at Toronto. This advantage will be still further increased by the addition which will, no doubt, be made in other parts of the United States to the number of stations.

These circumstances render it peculiarly desirable that the observations at Toronto should not be suspended; and the undersigned are instructed to express to your Lordship the earnest wish entertained by the Academy, that the requisite appropriations for their continuance should be made by Her Majesty's Government, and the hope that the Royal Society will exert its great influence to this end.

We have the honour to remain,
With the highest respect,
Your Lordship's obedient servants,
EDWARD EVERETT,
WM. CRANCH BOND,
A. GUYOT,
JOSEPH LOVERING,
JON. P. HALL,
Committee.

The Earl of Rosse,
President of the Royal Society.

Notes on the Geology of Toronto: by H. Y. Hind, Professor of Chemistry in the University of Trinity College.

(Read before the Canadian Institute, January 22nd, 1853.)

MR. PRESIDENT, AND GENTLEMEN,—

I must beg of you to accompany me on an imaginary trip to the shores of Lake Ontario, where the scene of our enquiries may be near the low cliff which rises abruptly from the waters of the Lake about a quarter of a mile to the west of the New Garrison. Standing at the base of the cliff, which at some places is nearly perpendicular, we may see a belt of yellowish clay about fifteen feet thick reposing upon numerous thin layers of rocks. We will select a spot where a very narrow beach of pebbles and shingle affords us standing room; the waters of the Lake, to our right and to our left, washing the low range of stratified rocks before us. The total height of the cliff, or rather bank, is about 20 feet. The uppermost layer of greyish sandstone rock immediately beneath the clay is about five feet from the Lake level, but if we progress westward towards the Humber, we shall find that it dips in that direction as well as towards the south, and either disappears below the waters of the Lake or is covered and concealed by superimposed yellow clay and sand. If we examine into the history of the yellow clay we shall find that it is of very recent origin, and belongs to what is termed the Drift formation. A careful search will assure us that it contains the remains of vegetables and animals whose species still live upon the face of the earth. In the City of Toronto, well-diggers have frequently found branches and even trunks of trees at depths varying from ten to forty feet in the Drift formation. It is not my intention to dwell upon the nature of the Drift as developed near Toronto, it is sufficient for present purposes to note the epoch during which it accumulated, and which is known geologically under the name of the Tertiary period. But what of those narrow bands of sandstone and shale which underlie the drift, and which present such marked features of regular stratification? they belong to what are termed Lower Silurian rocks; a name which plunges us at once into the almost illimitable field of geological speculation and history. When we see the clay reposing so evenly upon the surface of that narrow band of sandstone, we naturally suppose that some short period after the stripe of hard rock had been established by the slow process of deposition at the bottom of a lake or sea, the yellow clay was drifted upon it by the action of some violent current, at a time when the land around us was covered by the waters of the lake. Not so, however. Geologists inform us that countless ages passed away between the formation of the narrow stripe of sandstone and the superimposed Drift clay.

But how do they know it? Examine the narrow stripe of sandstone, separate a small block with a chisel from the layer of blue shale upon which it reposes, and we see below it numerous round bodies, which upon examination appear to be delicately organized and to possess a beautiful cellular structure. They are corals, and are to be found in vast numbers and of diversified forms throughout those narrow bands of shale and sandstone. If we examine more minutely lower layers of the shale, we shall find numerous shells of many varieties, none however of kinds known now to possess living inhabitants in any of our lakes or seas. Upon further search we may discover a multitude of obscure vegetable forms, called fucoids, some of them possessing considerable dimensions, others smaller and less distinctly preserved. In whatever remains of animals or vegetables we meet with, we fail to recognize any alliance between them and those living species with which we are familiar. We infer then, that a vast difference in point of age exists between the Drift clays and the subjacent rocks. But how great may we suppose this difference in age to be? What interval of time has elapsed between the period when those ancient shells had living occupants, or those fucoids grew in a brackish sea, and the date of the accumulation of the vast mass of recent Drift which now presses upon them? In order to approach the answer to this question, we must refer to geological writers for their descriptions of other kinds of rock which are ascertained to be less ancient than the one we are now contemplating, and to the science of Palæontology which treats of fossil remains.

Having now introduced you to the rocks which are exposed in the neighbourhood of the New Garrison, and which form the foundation of the whole country between Toronto and the Rivers Rouge and Credit to the east and west, let us return to the lecture room where we may study more at our ease the history of those ancient deposits, and contemplate some of those remains of organic life of which they are the vast and enduring sepulchre.

First, then, with respect to the age of those rocks.

I need not remind you that geological ages are very indefinite periods of time, and relate to epochs in the history of the world which carry us far, very far beyond the period of man's history.

Geologists generally recognize thirteen groups of stratified or fossiliferous rocks, each group containing several members or formations which were probably deposited at different epochs at the bottoms of extensive seas or fresh water lakes. Each group is distinguished by numerous fossil remains which are peculiar to it. The thirteen groups are divided into three grand divisions named respectively,

I. Tertiary or Cainozoic, containing three groups.

II. Secondary or Mesozoic, containing four groups.

III. Primary or Palæozoic, containing six groups.

The Silurian constitutes the fifth group in descending order of the Primary or Palæozoic division. When we contemplate the enormous thickness of the various groups of fossiliferous rocks, and remember that they have all, most probably, been deposited one after the other at the bottom of seas, we can scarcely form any conjecture respecting the great antiquity of the rocks which form the foundation of the Drift upon which this city reposes. The members of this group are themselves of vast extent and thickness. They have been found to exist in various parts of the world, in Wales (whence their name, as forming a part of the ancient kingdom of the Silures,) in Bohemia, in Canada and in the Valley of the Ohio and Mississippi, &c. Silurian rocks have been divided in two lesser groups, called the Upper and the Lower, or more recently into the Upper, Middle and Lower Silurian. Their united thickness in Wales has been estimated at about seven thousand feet. On this continent they attain much greater thickness. They constitute with one known exception the most ancient of all fossiliferous groups of rocks. During the period of the deposition of the Lower Silurian rocks the sea would appear to have presented an aspect of tranquillity, for we generally find their strata to preserve great horizontality, and to exhibit many of the characteristics of quiet and undisturbed progression. Some of the layers are beautifully ripple marked, as you may see from this specimen which was procured from the cliff near the New Garrison. Many of the vegetables they entomb seem to have been fossilized in the spot where they grew, and the casts of shells in the soft horizontal shales, which are found abundantly in this neighbourhood, exhibit minute markings when examined microscopically, in an admirable state of preservation.

The Lower Silurian rocks consist of several formations of considerable thickness which lie one over the other, and are the representatives of extensive periods which elapsed during their deposition. They are grouped because they contain in common certain species of fossils, but their order of superposition exhibits their relative ages, and their enormous thickness affords us a vague idea of the immensity of the duration of the period of which they are the record. In Western Canada the formations which are analogous to those of the Lower Silurian group in Britain, contain the subjoined subdivisions:—

PRIMARY GRANITE.

1. Trenton Limestone.
2. Utica Slate.
2. Loraine Shales, (Caradoc Sandstone.)

In the State of New York, and in some parts of Eastern Canada, and the eastern part of Western Canada, rocks older than the Trenton Limestone are to be found. It may be useful to mention the names of these rocks in order to establish the position of the Loraine Shales. The series would then be as follows:—

PRIMARY GRANITE.

1. Potsdam Sandstone.
2. Calciferous Sandstone.
3. Chazy Limestone.
4. Birdseye "
5. Black River "
6. Trenton "
7. Utica Slates.
8. Loraine Shales or Hudson River group.

From the foregoing table we are to understand that the Potsdam Sandstone is the earliest, and consequently the lowest fossiliferous strata found in this country,—or as Mr. Hall states,* "as having been produced at the dawning of the vital principle upon our planet; nothing which bears the semblance of having been organic is yet known in strata of anterior origin."

After the deposition of the Potsdam sandstone the Calciferous sandstone occurred, then the Chazy, Birds-eye, Black River and Trenton limestones were slowly accumulated one above the other, each entombing an infinite multitude of the denizens of the seas in which they were deposited. After these came the Utica Slates, and then the 1,000 feet thick Loraine Shales were slowly, and probably peacefully piled up over a vast extent of the earth's surface.

The Hudson River group or Loraine Shales is the rock to which we must refer *the strata which are exhibited at the Garrison* Common. Mr. Murray, the Assistant Provincial Geologist, observes in the admirable Geological Reports, that the Loraine Shales "compose the substrata of the whole country on the shore of Lake Ontario, between the River Rouge, in the Townshipof Pickering, on the East, and the River Credit, in Toronto Township, on the West, and sections of them may be seen in almost all the streams that intervene between the one point and the other."

"The estimate I (Mr. Murray) have made of their thickness brings it to 1,110 feet. How near this may approach the truth is difficult to say, but the result of such evidence as I have had it in my power to collect being still in favour of supposing the dip to be at about the rate of thirty feet to the mile, it is probable that the figures given constitute a tolerable approximation."

That the Loraine shales belong to the Lower Silurian group of Sir Roderick Murchison we have the subjoined authority of Mr. Hall.

"Commencing at the lowest rock known to contain fossils, we find the most important change in the typical forms to occur at the termination of the Hudson River group, (Loraine Shales) which is marked by a coarse sandstone or conglomerate, beyond *which scarcely a single species has prolonged its existence.* This point must be considered as representing that Horizon which in Great Britain is the termination of the Lower Silurian deposits. We never find, however, in the succeeding groups, a mingling of the fossils of the Lower and Higher rocks, which is regarded as taking place in England and Wales, where the strata are much disturbed. (Hall, Palæontology of New York.)

The Lower Silurian period and its relative distance in time from the present epoch, may be represented by the following table of the thickness of deposits which have accumulated since its termination; that is, since the time of the layers of sandstone and shale which we see at the Garrison Common beach:—

Rocks of the Modern or Cainozoic period.	feet 1800	Containing a small number of fossils identical with existing species.
Rocks of the Middle or Mesozoic period.	feet 5100	Containing fossils belonging altogether to extinct species.
Rocks of the Ancient or Palæozoic period.	feet 21,000	Containing fossils belonging not only to extinct species but also often to extinct genera and families.

Above the Loraine Shales we find an aggregate of fossiliferous strata having a thickness exceeding 26,000 feet, or five miles, not represented at Toronto, but which are nevertheless illustrative of that immense period which has endured since the formation which underlies the Drift upon which Toronto is built, was slowly and perhaps tranquilly accumulated.

The relation of the Drift and Loraine Shales may be familiarly shown by dividing a line into thirty equal parts, and numbering them 1, 2, 3, 4, 5, &c., the position of the drift would be approximately represented by the 1st division, the Loraine Shales by the 26th division, and the true Coal Measures by the 15th division. From the 27th division to the thirtieth, we should have the rocks which were formed before the Loraine Shales and the probable dawn of life upon the surface of the Globe. It is an important question in this country to ascertain the relation which exists in time between the true coal measures and the Loraine Shales; this may be roughly and generally represented by a series of formations; having a thickness of 12000 feet, which we *may suppose to be placed between the uppermost layerof the* Shales and the lowest stratum of true coal. And further, if we assume that the vast Devonian group has no representative in

* Palæontology of New York.

the western part of this Province, yet the rocks which have been discovered by Mr. Murray in the Western Peninsula, have a thickness exceeding 1000 yards, and are unquestionably of earlier date than the true coal measures, and must be considered as members of the upper Silurian group. They constitute the substratum of the whole Province west of the Credit. If coal is found in the western Province, it will be found above these rocks. These rocks seem, however, everywhere to be covered immediately by the Drift, so that the probability of finding true coal, is remote in the extreme. Brown Coal, similar to that which has been recently discovered in Vermont, may yet be found in Canada.

A glance at the layers of rocks at the Garrison Common beach, each layer apparently distinguished by some peculiarity in its fossil remains—some containing corals in abundance, others the remains of marine vegetables, others especially rich in bivalve shells, and others beautifully ripplemarked, —will probably convey a better idea of the time which elapsed during the deposition of five feet in thickness, exposed there, than any calculation based upon examples, from other localities. If we assume that other stratified rocks have required an equal period of time to attain the same thickness (five feet) by slow deposition at the bottom of seas ; our conceptions become still more defined of the immensity of that period which divides the Drift from Loraine Shales, when we remember that the thickness of the rock we have been contemplating is less than the one five thousandth part of the rocks of that unrepresented epoch, which existed between the respective periods of their creation.

Having thus given a very slight sketch of the position and comparative age of the Loraine Shales, I shall now confine my remarks to the narrow stripe of Shale and Sandstone which is exposed on the lake beach at the Garrison Common. For the space of a few feet, the section exposed during the summer of 1852, was quite perpendicular, and very clearly defined. The action of the waves very quickly destroys the face of the rocks, and rounds the edges of the exposed masses of Shale. At the present season, the water covers the layers, marked No. 14 and 15 in the subjoined list, and when the least wind is blowing, it is quite impossible to prosecute any examination with comfort, owing to the spray which arises from the dash of the waves against the rocks. In the summer months, in calm weather, there is a space of two or three feet between the foot of the rocks and the waters. About fifteen feet from the cliff, a very uniform row of large boulders of gneiss, washed from the drift, lines the shore for many hundred yards. These boulders it must be remembered, have no connection whatever with the stratified rocks, they belong exclusively to the Drift, and a walk along the banks will reveal many of their kindred, ready, almost, to fall out of the yellow clay in which they are embedded into the waters of the lake below.

Order and thickness of rocks on the Lake Beach, at the Garrison Common.

			Feet.	Inches.
Drift with Boulders			16	0
Loraine Shales.	1	Hard Yellow Sandstone	0	9
	2	Do Do	0	1
	3	Thin layers of blue shale	0	2
	4	Hard Calcareous Sandstone	0	1½
	5	Thin layers of blue shale	0	1½
	6	Hard yellow calcareous sandstone	0	1
	7	Blue shale	0	4
	8	Sandstone	0	3
	9	Layers of Shale	0	4
	10	Sandstone	0	1
	11	Layers of Shale	0	3
	12	Sandstone	0	5
	13	Shale	0	4
	14	Sandstone	0	4
	15	Lake Stone, Shale, Ripple marked	0	8

The fossil remains found in these layers of rock are exceedingly numerous, and are not confined to any one of the sub-kingdoms into which animals are divided by Zoologists. We find, indeed, the three kingdoms, Mollusca (snails, oysters), Articulata (crabs, worms), and Radiata (corals); and it is a question which has excited much discussion, whether the representatives of the first sub-kingdom, vertebrata (beasts and birds), have been found in the Lower Silurian rocks. For the honour of Canada it is earnestly to be hoped that the discoveries and speculations of Mr. Hunt, Chemist to the Provincial Geological Survey, cautiously advanced in the last Geological Report, may be thoroughly borne out and confirmed by future investigations. It will then be established that the leading types of animal structure have had their representatives throughout all ages of the world's history since the earliest period of created life. The following table extracted from Hall's Palæontology affords a very good view of the extent and diversity of animal life in the ancient and extensive Lower Silurian Seas, of which the Loraine Shales formed perhaps the latest deposit.

TABLE SHOWING the Number of Species of Animals and Plants peculiar to each formation, and also the Number common to several formations. (Hall's Palæontology of New York.)

CLASS OR ORDER.	Genera.	Species.	Restricted to The: Potsdam Sandstone.	Calcif. Sandstone.	Chazy Limestone.	Birdseye Limestone.	Black River Limestone.	Trenton Limestone.	Utica Slate.	Hudson Riv. group or Loraine Shales.	Common to The: Potsdam and succeeding strata.	Calciferous and succeeding Strata.	Chazy and Black River succeeding Strata.	Birdseye, Black River and Trenton Limestone, and Hudson River group.	Birdseye and Black River	Black River and Trenton.	Trenton, Utica Slate and Hudson River group.	Trenton Limestone and Utica Slate.	Trenton Limestone and Hudson River.	Utica Slate and Hudson Riv. group, or Loraine Shales.
Plantæ, - - - -	4	14	1	3	-	-	-	4	1	5	-	-	-	-	-	-	-	-	-	-
Incertæ Sedes - - -	3	4	-	-	-	2	-	-	-	1	-	-	-	-	-	-	-	-	1	-
Zoophyta - - - -	19	50	-	-	7	1	3	19	3	13	-	-	-	1	1	1 ?	-	-	1	-
Crinoidea - - - -	8	15	-	-	3	-	-	7	-	3	-	-	-	-	-	-	-	-	1†1?	-
Brachiopoda - - -	7	77	2	1	10	-	-	51	-	5	-	-	-	-	-	-	3	1	3†1?	-
Acephala - - - -	12	49	-	-	1	1	-	26	1	13	-	-	-	-	-	-	-	-	4†1?	2?
Gasteropoda - - -	17	71	-	8	13	9	-	28	-	6	-	-	1	-	-	1	-	-	4†1?	
Cephalopoda - - -	11	68	-	1	4	2	10	40	2	5	-	1 ?	-	-	-	1 ?	-	1	1?	
Crustacea - - - -	14	33	-	-	7	4	-	13	1	3	-	-	-	-	-	-	3	-	1	1
Total - - -	95	381	3	13	45	19	13	188	8	54	0	1	1	1	1	3	6	2	20	3

We will now proceed to examine the fossil remains, which a few walks to the cliff at the Garrison Common, have afforded me an opportunity of obtaining. First then, with respect to the remains of an ancient vegetation. The Blue Shales contain many fragments, and sometimes entire specimens of Marine plants. Few of them are of comparatively large dimensions, having a diameter of perhaps an inch. Most of the specimens before you are crushed; their original form having been cylindrical, as we see from numerous examples. It is a matter of considerable difficulty to refer, with accuracy, different specimens to their appropriate described species. The varieties I have met with are six or seven in number; but whether they all belong to as many different species, is a question I am unable to answer. At certain periods vegetable growth must have been most abundant, during the remote epoch of the Loraine Shales, fragments occur in particular layers in immense numbers. Corals are numerous in both the Sandstones and Shales of the cliff. Masses of the rock appear to be almost entirely made up of their calcareous remains. Some of the specimens are beautifully marked, a magnifying glass, however, is required to bring out their markings.

All of these little spheroidial bodies are corals, and exhibit when broken that peculiar organized structure which distinguishes them at once from similar objects. Some of them are several inches in diameter, and are covered with a shining substance, which proves, upon examination, to be sulphuret of iron. On breaking open one of these little round nodules, its history in part, and its mode of growth, is at once observable. In the centre we see a cylindrical stem possessing, apparently, a number of joints, it is a stem of an encrenite, of which the celebrated stone lilies are the most familiar illustrations. Round this stem the little coral has grown. Most of the white objects which are so frequently visible in large numbers at the surface of the lake stone a few inches below the water, are corals worn and polished by the action of the waves. The forms assumed by this species of coral (Chetetes Lycoperdon) are very numerous, it frequently occurs as a branched variety bearing no resemblance except in organization to these round specimens. One peculiarity connected with the rocks at the Garrison Common cannot escape the most superficial observer. It is the occurrence of layers containing multitudes of corals and the stems of encrenites, while a few inches above them or below them other layers enclosing an equal abundance of vegetable remains—fucoids—are prominently displayed. These circumstances indicate probably, very different conditions of the sea in which they grew, and a peculiar adaptation of the separate deposits for the growth of different kinds of organized forms. The layer of shale I hold in my hand, shows in as admirably manner, though on a small scale, the commencement and duration of a period favourable to the growth of encrenites and corals. Its lowest side shows only a series of regular laminæ without any fossils. The upper half is a mass of fragments of encrenites and the branched form of the common coral before mentioned. Here, however, we have a far more beautiful indication of the condition of the Silurian sea during the deposition of the ripple marked shale which answers to the number fifteen in the diagram of the strata. These ripple marks penetrate the stone to a considerable depth, as may be seen by splitting the specimen.

We seem here to have the distinct and permanent record of a gentle ripple on the beach of a shallow sea countless ages ago. We may even attempt to form a conjecture of the direction in which the wind blew, which disturbed the surface of the water in those remote times. If we suppose that the Loraine Shales here exposed, have received no lateral change in position, and I am not aware of any reason for conceiving such change to have taken place, the direction of the ripple marks, shows the direction of the motion of the little waves which rolled upon a gentle beach, and consequently determines the point from which the wind blew at the time, which appears to have been a little to the east of south. Appearances very similar to ripple marks are to be found in some of the layers above the one I have described. They are not, however, sufficiently distinct and continuous, to settle the question of their origin. These ripple marks appear to indicate the presence of a beach or boundary of the sea at that time. The occurrence of a beach of a fresh water lake during the present epoch, in the same locality, is an interesting coincidence. The gradual submergence of the land after the hardening of the sand on the Silurian beach, and the varying depths of the sea which eventually covered it is sufficiently indicated by the superimposed layers of shales and sandstone, with fucoides corals and other organic remains. Proceeding now to the other fossils, found in these rocks, we have here a huge orthoceratite, or straight horn, two feet seven inches in length, and about five inches in breadth at its broadest extremity. It was found between layers marked three and four, on the diagram. It is much flattened by pressure, but the markings in some parts are still distinct. The specimen was broken in the act of being raised from its sandstone bed. The orthoceratidæ (straight horns) constitute a very numerous family of molluscous animals. They were, probably, creeping animals protected by a very elongated shell, which is divided into partitions, called septa, connected by a tube or siphuncle, both of which can be seen in specimens on the table, from which the outer shell is removed. Some species of the orthoceratidæ were of enormous dimensions; individuals have been found in this country upwards of six feet in length. The position of the living shell is supposed to have been upright, the large extremity downwards, the body of the shell swaying in the water. Upwards of sixty species have been described by Hall as belonging to the Loraine Shales, and the fossiliferous rocks which lie below them in the State of New York. Considerably more than one hundred species are now known to geologists.

The gastropods (snails, limpets) had their representatives in the Loraine Shales. The shells of these animals present many very beautiful forms. The number of fossil species found in the Lower Silurian is not great. The individuals, however, are generally elegant in their outline and structure.

The gastropods exhibit all the types of molluscous animals in a very prominent degree. This shell, *Cyrtolites ornatus*, is considered to be characteristic of the Loraine Shales. It is not uncommon in the rocks of the Garrison Common; and very beautiful specimens may occasionally be found. The shell is an important one; for, besides being characteristic, it is very easily recognized.

The conchifers, of which the oyster is a type, were rare at this period. The remains, however, of particular species belonging to some extinct genera are remarkably abundant. These are specimens of a very pretty shell, whose casts are exquisitely preserved in in the Soft Shales. It is named *Pterinia Carinata* and is also characteristic of the Loraine Shales. Its apparent resemblance to certain species of common sea-shells is striking, but not so much so as the resemblance of the one I hold in hand to the common muscle. It rejoices in the name of *Modiolopsis Modiolaris*. When layers of soft shale are removed from their resting place, and then carefully split with a knife or chisel, the casts of this shell, which is frequently revealed, presents such a modern aspect,—their forms and markings being so exact and perfect, and apparently so fresh,—that it becomes difficult to believe that we are looking at the cast of a shell, whose living occupant existed so far back in the unfathomable past that no effort of the imagination can convey the mind to the epoch of its life. It is truly a medal of creation, for while every portion of the original shell has long since been dissolved away, yet its exact impression has been produced in and retained by the hardened mud of the sea in which it once lived and died. This little slab is full of the impressions of a very interesting species of shell. The genera to which it belongs has members distributed, not only throughout all ancient fossiliferous strata, from the early Potsdam sandstone upwards, but it also finds living representatives in our tropical seas. It is a *Lingula,*—probably *Lingula quadrata.*

Of Crustaceans I have been able to find but a very few remains. The casts of a small trilobite are not uncommon, and may be noticed in some of the small slabs on the table. This family is, however, well represented in the Loraine shales. Mr. Hall figures three species which are peculiar to that rock. Graptolites, a kind of fossil whose true character is still a matter of doubt,—whether they lie within the limits of the vegetable or animal kingdom,—are abundant in the shaly portion of the rocks at the Garrison Common. Upwards of twenty species have already been described as belonging to the Loraine shales and rocks of anterior origin. I have only been able to detect one species in this neighbourhood, which is shown in these small slabs of arenaceous shale.

I have now briefly adverted to the most important and characteristic fossil members of the three classes of the animal kingdom, which meet the eye during a very cursory and incomplete examination of layers of rocks about three hundred yards long and five feet in perpendicular altitude, in the immediate neighbourhood of this city. If such a superficial examination indicates the existence of abundant remains of an ancient vegetable and animal world within twenty minutes' walk of this room,—rich, most probably, in numerous undescribed and at present unknown species,—it is surely to be hoped that through the instrumentality of its members, the museum of the Canadian Institute will soon be enriched with the stony records of that remote epoch in the history of the world, which is so distinctly and beautifully traced out by these mute memorials of the past.

The Mineral Springs of Canada; by Henry Croft, L. L. D., Professor of Chemistry in the University of Toronto.

(Read before the Canadian Institute January 15th, 1853.)

It is not my intention, in the paper which I shall have the honour of reading before the Society this evening, to endeavour to give anything approaching to a detailed account of the mineral springs of this portion of Canada, inasmuch as neither my own observations nor those of others have up to the present time been sufficiently extensive to warrant any such attempt. Our knowledge of the subject is yet entirely in its infancy, as might naturally be expected, from the small number of persons resident in the Province who are capable of undertaking the necessary accurate investigations, from the wide extent of country of which comparatively little has been explored with respect to its natural productions, and lastly from the difficulty attending the transport from a distance of those large quantities of material which are required for an extended examination.

The object which I have in view in the present communication is simply to impress upon the members of the Institute the interest and importance of the subject, and to endeavour to enlist them in attempts to increase our knowledge by personal observation, and by the transmission to the Society of any mineral waters which to them may seem worthy of more particular attention. It frequently happens that springs are met with, which, from possessing a disagreeable smell or a peculiar taste, attract attention, and are believed by ordinary observers to possess valuable properties, but which, when submitted to the test of chemical analysis, are found to be nothing at all extraordinary. Many such instances have fallen under my notice, of which I will allude only to one from the neighbourhood of the Falls, lately submitted to me for analysis. The water, according to the accounts I received, has acquired a character of medicinal virtues, which are most probably imaginary, as one pint contains only 4.24 grains of solid matter, consisting principally of simple sulphate and carbonate of lime. Our knowledge of the subject being so exceedingly limited, the greater portion being due to the able researches of the talented chemist of the geological survey, I shall content myself with some few facts drawn from his experiments, as well as my own, and some observations upon our present knowledge of mineral springs in general.

The term mineral waters is generally applied to such as differ materially in their constituents, at least as regards quantity, from ordinary lake and river water. It has also been occasionally stated that mineral springs were characterized by their high temperature: but this is by no means a true definition, as many springs, especially these arising in elevated regions, possess an exceedingly low temperature. In its more general sense, the term "mineral water" might be extended to all waters whatsoever,—whether derived from the air, from rivers, from lakes, or from the sea; but it is usual to confine it to those possessing more or less of a medicinal character.

Until within a comparatively short period, the attention of chemists was principally directed to the detection and determination of those ingredients which, from their quantities, were evidently capable of exerting medicinal action; but of late years, since the methods of chemical research have been so materially improved, and the detection of many substances, even when in the most minute quantities, has been rendered possible, great attention has been paid to such investigations, and some very curious facts ascertained with regard to the presence in mineral waters of a great variety of substances, to which in some cases the medicinal virtues of the springs have been with reason ascribed.

The more ordinary substances occurring in mineral springs are the following: lime, magnesia, iron, alumina, potash, and soda; of acids,—carbonic, hydrosulphuric, silicic, and hydrochloric, besides certain organic bodies possessing an acid character.

The earliest additions to this list were made by the discovery of those valuable agents iodine and bromine in many springs; of fluorine and lithia in the hot springs of Carlsbad, and of phosphoric acid, baryta, and strontia in a few others. These three latter bodies have lately been detected by Mr. Hunt, in two mineral springs,—one in the parish of St. Joseph of Lanoraie, and the other in Fitzroy.

A much more remarkable discovery is that which has been more prominently brought forward since the year 1846, viz.—the existence of various heavy metals, or rather of their compounds, in a considerable number of mineral waters. Among the most curious of these ingredients may be mentioned arsenic, which seems to be much more universally diffused through nature than was formerly supposed. Some allusion to this fact appears in the writings of that prince of alchemists, Paracelsus (or, to give him his more extended title, Philippus Theophrastus Bombastus von Hohenheim), who mentions the presence of arsenic and orpiment in the water of Gastein. As Dr. Will properly remarks, but little credence can be given to his statement, when we consider the exceedingly imperfect nature of the analytical methods adopted at that period. The first notice of this remarkable substance was made by Trippier, who found it in a spring at Algiers, and the discovery has been confirmed and extended by Chevallier, Osann, Daubree, Walchner, and Will. The latter chemist examined not only various German mineral waters, but also the ferruginous deposits which are formed from them, and in which he succeeded in detecting, not only arsenic, but also copper, tin, lead, and antimony. The quantities of these ingredients, as may be supposed, are exceedingly small. As an instance, in 10,000,000 parts of one of the springs of Rippoldsau there was found six grains arsenic, one-fourth oxide of tin, one-sixth oxide of antimony. one-fourth oxide of lead, and one grain oxide of copper.

Walchner and Daubree have examined the deposits from various springs, and moreover, a large number of rocks and soils, and have arrived at the extraordinary conclusion, that in almost all, there are contained traces of the above mentioned substances, more especially arsenic. This metal is therefore not only universally diffused throughout the whole world, but from the fact of its existence in meteoric stones, we must conclude that it is still more universal, and that it enters into the material composition of other planets than our earth.

To this list silver has been added, for that body is found to exist in minute quantity in sea water, in some springs, in plants, and even in animals, and very lately M. Mazade of Valance has announced that in the water of Neyrac, he has discovered the following substances: Titanium, Molybdenum, Tin, Tungsten, Tantalium, Cerium Yttrium, Glucinium, Zirconium, Nickel and Cobalt.

When we consider the manner in which mineral springs are formed, and the immense extent of strata through which they have to pass in their course to the surface, we shall not be so much astonished at their containing traces of those numerous substances, which all recent researches seem to prove to be more generally distributed through the crust of the globe, than was formerly supposed.

Attempts have been made of late years to connect mineral springs with the geological strata out of which they arise, and thus, from the nature of the spring, to draw conclusions as to the peculiar formation out of which the water flows, and the different deposits through which it has passed before reaching the surface: owing to the great difficulty, if not impossibility of tracing the course of water while trickling through the earth, concealed from our view, many erroneous conclusions may readily and naturally be arrived at, but still, certain general laws have been ascertained, to which I shall hereafter allude.

It has been well remarked by the President, in his opening address, that there exist natural obstacles to the successful prosecution of certain branches of natural science in this part of the province, viz.: the absence of mountain ranges, and the uniformity of the surface, and geological formations. The same causes, to a certain extent, produce a want of variety and interest in the mineral springs, for while we find that strong saline, and in many cases useful medicinal springs exist in great numbers in the upper strata, and very curious and interesting waters arise from the primitive rocks, the Silurian system is not by any means so rich in these natural productions as the Oolite and and the Granite. We have many springs it is true, but with few exceptions, they contain little else than salt, and belong almost universally to the class called saline waters. The few chalybeate waters that exist in Canada, are mostly so feeble, as scarcely to deserve notice.

Not only in their chemical characteristics do our springs belong to the more ordinary class, but even in their thermic relations no great eccentricities are to be observed. I am not aware of any spring either in Upper or Lower Canada, possessing an extraordinarily high temperature.

The heat of spring water may seem at first sight to be a matter of but little importance, but it is in reality, one of considerable interest, when we consider it in relation to the internal temperature of the earth. It has been found that the hottest springs are those which arise from the greatest depth, and we are thus enabled to draw conclusions as to the stratum from which the water is derived, from the temperature which it possesses.

If therefore, we find, that springs from great depths have retained the same temperature for ages, it is fair to conclude, that their originating strata have also remained the same, in other words, that the earth has neither lost nor gained in caloric.

Although some few observations have shown that the temperature of certain springs have been subject to change, the greater number of reliable experiments prove the heat to have remained unaltered. A number of springs in the Eastern Pyrenees have retained the same temperature for 65 years, the water of Carlsbad is just as hot now as it was 80 years since. The water of Mount D'Or which was used for bathing without cooling, at the time of Julius Cæsar, now possesses exactly the highest temperature that can conveniently be borne by the human body; and hence, unless we conceive that the Romans were endowed with as thick and insensible a skin as the Turk, whose Marmont saw bathing in water of 92° or the juggler whom a recent traveller describes as lying in an oven in which tallow melted, and a fowl was cooked by his side, we must necessarily conclude, that the temperature of the water has remained unaltered.

With regard to the characters of mineral waters as depending upon the formation from which they arise; the following laws have been laid down:

The mineral waters of the primitive formation are almost all thermal, possessing a high temperature. Their predominant impregnation is sulphuretted hydrogen and carbonic acid, carbonate of soda, and other soda salts, few calcareous salts, except carbonate of lime in some peculiar situations, and but a small quantity of iron.

The waters of the transition, and older secondary rocks, assimilate to those of the primitive formation, but the temperature is considerably lower in most cases, free carbonic is much less common and sulphuretted hydrogen generally absent, salts of soda still predominate, but the carbonate is less frequent, and sulphate of lime more general.

The waters of the newer secondary and tertiary formations, are as distinctly characterized as those of the primitive rocks, placed at the other extremity of the series. They are all cold. Free carbonic acid in large quantities, is almost entirely absent, the predominating ingredients being carbonate and sulphate of lime, magnesia and oxide of iron.

Owing to local causes, many exceptions to these rules may be observed, and although in a district of uniform geologic character, it generally happens that the springs are of the same nature, it is occasionally found that waters of very different constitutions, arise within a very limited space.

In speaking on this subject, I cannot perhaps do better than quote Hugh Miller's observations on the celebrated Springs of Cheltenham. These springs all take their rise in the Lias, a formation which abounds in sulphuret of iron, lime, magnesia, lignite and various bituminous matters. The water which supplies the spring has its origin at a greater depth, viz., in the Upper New Red Sandstone, in which it becomes impregnated with salt, and then entering the lias dissolves up many of the ingredients above mentioned. Thus, the Cheltenham water probably falls on the Worcester Hills, buries itself in the soft folds of the Upper New Red, passes along the rock salt strata and enters a Liasic bed of bituminous shale, then into dolomitic limestone and afterwards through beds of belemnites, fish lignite, bitumen and other organic remains. Here, as Miller facetiously observes, it carries along a dilute infusion of what had once been the muscular tissue of a crocodile, and here the strainings of the bones of an icpthyosaurus. Miller alludes to the peculiar smell of the springs of Strathpeffer arising from the Old Red Sandstone, as indicating the peculiar nature of the ooze of that formation, and remarks that visitors to the springs if not in time to breakfast off the fish of the Old Red Sandstone, are yet enabled to gulp down as medicine, an infusion of their bones and juices.

For the consolation of water drinkers it may be remarked that the above extracts are somewhat exaggerated, inasmuch as the quantity of organic matter contained in mineral springs is exceedingly minute, more especially in all that have fallen under my notice in this country.

According to the generally received theory of the formation of mineral springs, the water which falls upon the surface of the earth becomes impregnated with carbonic acid, it penetrates into deeper strata and takes up in most cases a quantity of common salt, this solution is supposed in its further progress to act upon the different rocks with which it comes in contact and to dissolve out those various substances which are discovered in the spring when it again reaches the surface. It has been objected to this theory that such a solution would not be capable of dissolving these numerous substances out of the rocks through which it passes, but this objection has been removed by Struve, who by passing water saturated with carbonic acid, and under high pressure, through the powdered basalts and phonolites of Toplitz and Bilin succeeded in most completely imitating the celebrated mineral springs of these localities.

It has also been objected that the enormous quantity of solid materials which would thus be eliminated from the interior of the earth, would in the lapse of years produce large cavities below the surface which must from time to time be filled up by the superincumbent strata. This objection, at first-sight, seems to be well grounded, when we consider the extraordinary masses which are evolved from certain springs. For instance, the Carlsbad spring gives out yearly, no less than 6,800 cwt. carbonate of soda, and 10,300 cwt. sulphate of soda, besides the large amount of carbonate of lime which constitutes the so called Sprudelstein. It must be remarked, however, that this disintegration does not take place at any one particular spot, but throughout a very large extent of surface, out of which the water trickles, and even if it were confined to one spot, the quantity of material which would be removed in the course of 500 years has been shown by calculation to occupy a space, which, when we consider the great depth from which the spring arises, would form but an atom, perfectly incapable of producing those disasters which the opponents of the theory have deemed possible.

With regard to mineral springs in the neighbourhood of Toronto, I have very little to say, as I am not aware of the existence of any which deserve more particular notice. Many springs in this vicinity, and even numerous wells contain a large proportion of salt, and some curious observations have been made in regard to the rapid variations in the quantity of this substance, contained in the water, but I am not aware of there being any spring in the neighbourhood which really deserves the appellation of a mineral water in the sense above described. Perhaps the most curious is the water which forms the rivulet running back of the Davenport Road, and flowing into the Don. This water is charged with carbonate of lime to a considerable extent, and produces petrifactions, or more properly speaking incrustations of a very beautiful character.

The deposits formed by this spring, although considerable in quantity, are very soft, widely different from those hard, stony formations, which are produced by many springs, especially that of Carlsbad in Bohemia.

It is scarcely necessary to allude to the interesting topics to which this simple incrustation of moss would tend to direct our attention, many of the ancient strata of the earth's surface, and several stupendous modern formations—as, for instance, the Travertine of Naples, depend upon causes which may be conveniently observed and studied within a mile of Toronto.

No other springs possessing any interest are to be found in the immediate neighbourhood of Toronto.

About the Falls of Niagara there are several springs reputed to possess medicinal properties ; several of them are impregnated to a greater or less extent with sulphuretted hydrogen, but the quantity is never very large, and the amount of saline matter contained in them is so exceedingly small as to render their medicinal properties rather doubtful.

The burning spring on the bank of the rapids, is interesting on account of the large quantity of inflammable marsh gas which is evolved with the water. A precisely similar phenomenon is observed in a spring a few miles distant from Hamilton. In both of them the saline matter has been found to be exceedingly small in amount.

This gas, light carburetted hydrogen, seems to be evolved from the earth in many parts of Canada, probably arising from the gradual decomposition of the organic matter contained in various bituminous rocks.

Near Ancaster there are two springs: the one which is called by Mr. Hunt the Sulphur Spring does not seem to be of much value ; but the other, called the Saline Spring, is remarkable for the enormous relative quantity of chlorides of calcium and magnesium it contains, as well as for the amount of bromine. From the great strength of this water, it is probable that it will be found to possess considerable medicinal virtue. Mr. Hunt's analysis is given below, the quantities being calculated to one pint. *Analysis No. I.*

Some years ago I analysed a specimen of a mineral water collected at Hamilton by Mr. Young. The exact locality is unknown to me, but the spring, although not very rich in the total amount of saline matter, yet contains so large a relative quantity of sulphate of magnesia, that it might probably be of value.—*Analysis No. II.*

A few miles west of Simcoe, in the twelfth range of Charlotteville, there is a spring, which according to Mr. Hunt is remarkable for containing a very large amount of sulphuretted hydrogen, more than one-tenth of its bulk. As regards this constituent, the Charlotteville spring is much richer than the celebrated Harrowgate water; and although the amount of saline matter is comparatively small, as may be seen from the subjoined analysis, yet there can be but little doubt that it may hereafter be safely applied for medicinal purposes, when certain obstacles which at present exist shall have been removed, and free access be afforded to this remarkable spring. *Analysis No. III.*

The most remarkable of all the springs in the Province, are those which have received the name of Sour Springs. One of these exists in Wentworth, nine miles south of Brantford, and is generally known by the name of the Tuscarora Sour Spring. It is remarkable for containing a considerable quantity of free sulphuric acid, besides that portion in combination with potash, soda, lime, magnesia, oxide of iron and alumina. The water contains no trace of chlorides, and but a small quantity of sulphuretted hydrogen. Although such springs are among the great rarities of Europe, a considerable number are known to exist on this continent. In the State of New York there are several, and I have lately examined a perfectly similar specimen from St. Catharines. These waters might be applied to several useful purposes, if they could be obtained in sufficient quantities.

In the appendix attached to this paper, I have given a *resume* of the analyses of the most important springs found in this neighbourhood, and have added those of the Plantagenet and

Caledonia Waters, which have acquired some repute amongst us. I believe the St. Leon water has been examined by Mr. Hunt, but I have not seen his analysis.

It is by no means improbable, that in the course of time, as the country becomes more thoroughly investigated, other springs, equal if not superior to the Plantagenet and Caledonia Waters may be discovered in this portion of the Province. If, however, we cannot congratulate ourselves on the possession of very strong mineral springs, we at least are extremely fortunate in possessing lake and river water of a greater degree of purity than almost any other part of the world. The water of Ontario is of most extraordinary purity, and it is very probable that the waters of the Upper Lakes will be found to be still more free from extraneous matters. It would be of considerable interest to compare, by accurate analyses, the waters of Superior, Huron, Erie and Ontario. Should any members of the Institute who may have the opportunity of collecting such specimens be inclined to undertake the task of forwarding them to Toronto, it must be remembered that a very considerable quantity (several gallons) would be required, and it would have to be preserved in glass vessels with the greatest care.

The waters of some of the rivers of Canada seems to be exceedingly pure. The St. Lawrence water at Montreal has been analysed by Dr. Hall; and from some experiments which I have recently made on the Thames water (London, C. W.) it appears that the quantity of solid ingredients in one imperial gallon of 70,000 grains amounts to only 10.50, a purity which is equalled by only a few other waters in the world.

APPENDIX.

ANALYSIS I.—Ancaster Saline Spring, . . Specific Gravity . 102910
" II.—Mr. Young's Spring, Hamilton " " . 100640
" III.—Charlotteville Spring . . . . " " . 100270
" IV.—Plantagenet Water . . . . . " " . 100637
" V.—Calcdonia Gas Spring . . . . " " . 100620
" VI.— " Saline Spring . . . " " . 100582
" VII.— " White Sulphur . . " " . 100370

IN ONE PINT.

	I.	II.	III	IV.	V.	VI.	VII.
Chloride of Sodium	146,919	3,5688	- -	81,662	53,510	49,466	29,514
Chloride of Potassium	0,786	- -	- -	0,728	0,237	0,198	0,176
Chloride of Magnesium	38,966	- -	0,674	1,716	- -	- -	- -
Chloride of Calcium	98,324	- -	- -	0,954	- -	- -	- -
Bromide of Magnesium	0,792	- -	- -	0,056	- -	- -	- -
Iodide of Magnesium	- -	- -	- -	0,267	- -	- -	- -
Sulphate of Lime	5,966	7,8724	8,653	- -	- -	- -	- -
Sulphate of Magnesia	- -	33,4489	3,441	- -	- -	- -	- -
Sulphate of Soda	- -	11,898	3,623	- -	- -	- -	0,141
Sulphate of Potash	- -	- -	0,391	- -	0,040	0,037	- -
Carbonate of Lime	- -	- -	2,342	6,233	1,136	0,902	1,612
Carbonate of Magnesia	- -	- -	0,138	- -	4,041	3,972	2,257
Carbonate of Iron	- -	- -	trace.	0,067	traces.	trace.	trace.
Alumina	- -	- -	- -	- -	0,033	trace.	0,020
Sulphuretted Hydrogen	- -	- -	1,364	- -	- -	- -	- -
Carbonic Acid	- -	- -	1,178	- -	2,671	2,212	1,082
Silicic Acid	- -	- -	- -	0,490	0,238	0,326	0,645
Carbonate of Soda	- -	- -	- -	- -	0,353	1,353	3,500
Bromide of Sodium	- -	- -	- -	- -	0,115	0,130	0,077
Iodide of Sodium	- -	- -	- -	- -	0,004	0,011	trace.
	291,673	56,7799	21,804	92,173	62,378	58,637	39,024

The above analyses (excepting No. II.) were made by Mr. Hunt, the accomplished Chemist of the Geological Survey, to whom we are indebted for by far the larger portion of our knowledge of the chemical composition of the products of Canada.

The Horse and its Rider.

BY J. BAILEY TURNER, ESQ., QUEBEC.

It seems to be the generally received opinion that the Human race now spread over every part of the habitable world, consisted of more than one primæval stock, clustered round the vicinity of a common centre, from which they radiated, and that that centre is to be sought for in that high region of Asia, which forms, as it were, the exterior border of the Kingdom of Thibet, or the ancient land of Zend, the district surrounding the Oxus and Taxartes and in the Khangai, Oases, or fertile spots found in the great desert of Gobi. In these Oases it is probable that the earlier tribes existed, employing themselves in, and maintaining themselves by, agriculture and pastoral industry, until their numbers increased to such an extent that they were compelled to migrate in order to procure the means of subsistence, and in doing so obeyed the Divine command, to increase and multiply, replenish the earth, and subdue it. With hardly one opposing circumstance, all the traditionary historical knowledge of mankind, all our acquirements, all our domestic possessions, point to this region as that in which human developement took its first distribution after the Deluge, wherever may have been the great centre of the ante-diluvian population. Around this vast region are stupendous mountain chains, bearing the names of God, of Heaven, of Snow, or Purity,—and we have in the various Eastern mythologies, traditions, that here were the four rivers of Paradise, and that on the peak of Nanbundama the ark rested after the flood; while in Tartar legends, Nataghi, the Boatman God, and his family, are placed on another mountain, far to the north, in the Altaian chain;—another legend makes the ark rest on the peak of the Dove, a mountain on the western side of the Indus, now known as the Takt-y-Suleiman; and here I may observe, that nothing in the early Jewish legends, commonly known as the Books of Moses, is adverse to the supposition that the original seat of the human rnce as further to the East, or in a more central position in Asia, than is commonly supposed; in fact that it was near the eastern and not the western Caucasus. Even the Mosaic assertion that the ark rested on Mount Ararat after the flood, is nothing, because the word Ararat is generic. meaning simply a "Mountain Peak," and is therefore just as applicable to any of the Peaks in the Hindu-koh, Hinducosh, Himmaleh, or Altai chain, as is the especial mountain in Asia Minor, marked Mount Ararat on the Maps, and as for localities assigned as that of Paradise or the Garden of Eden, there are at least twenty of them, between Thibet and Dales. In this region too, on the West side of Thibet, is the vast table land of Ramese, known in Eastern tales as the Back Bone of the world—not yet distinctly marked on the map. Here is the Lake Surikol, itself one of the great Asian mysteries; here are the mountains of the Hindu-Coosh, the probable primeval seat of the Scythic or Teutonic races, tribes that have spread in number and power till the third part of the earth is directly or indirectly under their control, and as every tribe or stock, at least of Caucasian, or Semi Caucasian origin has its tradition of a primordial City of the Gods—the hero progenitors of their race—as the Assyrians had their Babel; the Indo Nigritians their Magara the Indo-Persians their Pasagarda, and our own Teutonic ancestors their Asgard—so we find that the tribes bordering on the west and south of Thibet, acknowledged in their traditions the sanctity of Balkh or Rembala, a city not far from the Hinducoosh region, a little to the northward of which is Samarcand, from all antiquity, a city of great commercial importance as the seat of the largest trade in horses carried on in the whole East. It is no less strange than true, and it is a most astonishing confirmation of the theory that this portion of Asia was the original seat of the human race, that almost every animal which man has subdued to his use—every plant which furnishes him with food, is to be found in its indigenous state, in and around this truly wonderful region. Here are yet found in the wild state, the dog, the hog, the horse, ass and camel; the ox, sheep and goat; the elephant once stalked, in its majestic strength, through the forests on its southern border; and wild cats, precisely similar to the domesticated breeds, still haunt its jungles; every known species of domestic fowl originated in the south-east of Asia—many of them are yet found wild in the jungles. On the western side are to be found the parent plants of many of our fruit bearing trees and shrubs—the walnut, chesnut, filbert, apple, medlar, and cherry, and almost all the cultivated berries. Not far from here, at Slassa, in Thibet, the vine, given to gladden the heart of man, flourishes in the greatest luxuriance; wheat and barley of many varieties are indigenous on the skirts of this region, some species, so hardy that they thrive on the sides of the Himmaleh chain 10,000 feet above the level of the sea; buck-wheat and oats are found in the plains to the northwest; onions and turnips are met with wild in many parts. In the northern plains we find both flax and hemp, and in the valleys of Cashmere, melons, pumpkins and gourds. In no other part of the world are there found clustered together so many of the necessaries essential to civilization; none of them existed in the Western Caucasus, and therefore, we especially conclude that they must have been carried westward in their migrations by those nations, who must long have been acquainted with their value; nay, how do we know that the power to distinguish what was "good for food," was not part of the original revelation made by God to man, and derived by the post-diluvian nations from their fathers, miraculously preserved through that catastrophe. It is also probable that the tribes in moving westward met with many other edible fruits and roots, during their wanderings, which they carried with them to their final western resting place; the mulberry, apricot, and date palm; the olive, fig and plum, were, without doubt, brought in this way—and last of all the orange, which we know to [illegible] native of China.

The horse, then, and its congener, the ass, we find to be indigenous in Central Asia, and in that part of it which is on very good grounds concluded by the best ethnologis's to have been the primæval seat of the human race. We have strong reason to believe that the ass was subjugated to the use of man long before the horse; that such was the case we find indicated in many parts of the Old Testament legends, as in the sacrifice of Abraham, in his visit to Egypt, where we find it recorded of the reigning Pharaoh, that he had sheep and oxen, asses and camels—but nothing is said of horses—and in the account of the plunder of the subjects of Hamor by the Sons of Jacob we find asses mentioned among the spoil, but not horses.

But Bell, the author of a work entitled, "British Quadrupeds," is in favour of the opinion that the horse was first reduced to servitude by the Egyptians. We certainly know from the Bible and from paintings and sculptures extant on Egyptian monuments of almost fabulous antiquity that they possessed trained horses and used them for almost every purpose for which they are used at this day; but as the horse was not indigenous in Egypt, as we never find it mentioned by any author sacred or profane, as existing in that country in a wild state, but on the contrary, always as a trained or domestic animal, it is evident that the original horse-tamers must be looked for elsewhere, and where so likely as in the land where the horse was indigenous, in that Central Asia, the primitive seat of civilization, whence knowledge radiated with population to Egypt, India and China.

We shall look a little more closely into this question, for it is one of great historical interest. As population increased in the original seat of the human race; and when, in short, and to use a homely phrase, they wanted elbow room, it is natural to suppose that each stock or tribe departed on its migrations by the course of the great rivers, as a means of facilitating its progress, —but in course of time when these great roads of colonization had been trodden by many nations, a different result followed, at the hands of a very different class of colonists; by this time, man had learned to use the horse for his convenience, and there are many reasons, principally derived however from philological enquiries, which induce the belief that this conquest over brute power first took place in Central Asia, probably about Samarcand, and then in the neighbourhood of the Scythæ, who were, perhaps, themselves the first horse-tamers. With the acquisition of the horse came the era of invasion and plunder—first of all by means of expeditions in chariots and afterwards by mounted bands of warriors, who passed rapidly over immense distances, carried with them few or none of their wives and children, but invariably slaughtered or enslaved the males in the conquered countries and appropriated their female relations. Thus from conquest by military invasion, then arose privileged families and tribes in nearly every nation, who became a master class. It is worthy of notice that in the various mutations produced by these incursions of conquering hordes, no nations escaped servitude, but those who fled to the mountains, whither cavalry could not follow them—the people who lived in islands had no security, for where horses could not swim boats were rowed, and hence we find a master race even in the South Sea Islands. Except in Africa and in the very eastern part of Asia, where the Mongol or beardless type predominates, this master race is in every circumstance, directly or indirectly, of Caucasian origin. But it also appears that from very remote times, in the mythological periods as it were, small bands of these fierce and restless Scythians, had been accustomed to migrate towards the west, and as we shall see these migrations gave rise to the old fabulous legends of giants, titans, and so forth. Now these giants are invariably described, not so much as men of great stature, but of great strength and fierceness. They are always spoken of as fair haired and blue-eyed—they are the Gog and Magog—the Og and Goliath, the Nephilim, Rephaim and Anakim of Scripture—the Titans, Cyclops, Typhon and Anteus of the Greeks and Romans. The Bersarkees and Blaumans of the Scandinavians, the Gams and Hunen of the Celts and Teutons. These are the giant Goths still figured on the brazen gates of Augsburgh, of Byzantine workmanship, and brought there from the Palace of Theodore the Goth at Ravenna. In many of the legends these giants are described as fighting naked, and so late as the year 1578, a regiment of Scottish highlanders, men of Celto-Sythic origin, stripped themselves naked to a man before they charged the Spaniards at the Battle of Rymenant, near Malines. In almost every legend we find them spoken of as fighting on horseback. Bearing these facts in mind, we shall proceed to Egypt again. We have seen that in Abraham's time no mention is made of horses, but 205 years later we find Joseph his descendant riding in a chariot, and mention made of the issue of corn from the royal granaries for horses, among other domestic animals enumerated: and we also find that Joseph, when he held the highest ministerial power in Egypt, sent chariots drawn by horses to bring his aged father and his brethren to the banks of the Nile. It would therefore certainly appear that at some time between the visit of Abraham and the elevation of Joseph, a period of about 200 years, the Egyptians had possessed themselves of horses, but it is now ascertained that during this very period, Lower Egypt had been invaded by the Hyksos or Cushites, who held dominion then for many years, forming the 17th dynasty of Manetho, according to Lepsius, and having the seat of their government at Memphis, while the Egyptian kings retreated to Thebes in Upper Egypt. Now who were the Hyksos, Cushites or Shepherd Kings? Hyksos is a word of ancient Upper Armenia, and means a Haik wearer—it is the same as the old English word *nuck*. And we find that Snorro speaking of Scythia calls it Sarkland—the land of "Tunic," or "Nuck," or "Shirt" wearers. Cushites in the Septuagint translation of the Scriptures is rendered Æthiopians, but wrongly, for in the older historical parts of the Old Testament, the word Cush is invariably used in regard to nations living East of the Red Sea; these Hyksos then were nothing more than a band of predatory Scythians, fair-haired and blue eyed, who in chariots or on horse back, had penetrated from high Asia into Egypt, and then became for a time the master class. It is supposed that the Hyksos were expelled from Egypt by Thothmes the first, of the 18th dynasty, according to Dr. Hales, about 27 years before Joseph's administration during the years of famine; and also, according to Dr. Hales, that after his death the Israelites, then living in Goshen, and greatly increased in numbers, began to meditate revolutionary projects, and invited the Shepherd Kings—the Hyksos—who after their expulsion had retreated no further than Hauran, on the river Jordan, to re-enter Egypt, which they did, and re-established the pastoral tyranny, subjecting both the Egyptians and the Israelites to their oppression. This was the new dynasty, "the King that knew not Joseph." Now I think that every candid mind will admit on a consideration of these facts, the great probability that the horse was first brought into the deserts of Arabia and into Egypt by these hordes of Nomadic conquerors, that on their first expulsion, their horses and cattle fell as spoil into the hands of the Egyptians, and that the horses greatly multiplied in numbers, and became celebrated for beauty, strength and spirit, and if we can believe the profane authors, the multiplication must have been truly enormous, for we find them, not long after the expulsion of the Hyksos, speaking of Ramses Niamoun the 3rd, surnamed the Great, the Sesostris of the Greek authors, and the fourteenth ruler of the 19th dynasty, according to the chronology of Rosellini, and representing him as going on an expedition to the East with 27,000 war chariots, but this is probably an exaggeration, for in the time of Setos, the 1st King of the 19th dynasty, according to Lepsius, and supposed to be the King, "who knew not Joseph," and who perished, according to the Jewish writers, in the Red Sea, we find that monarch could only muster 600 chariots of war, "all the chariots of Egypt," wherewith to pursue the Israelites. Now as each chariot was drawn by two horses, this is a vast reduction from the immense numbers assigned by Heroditus to Ramses, unless we consider that nearly all the horses in Egypt had perished only a few days before, under the "very grievous murrain," which constituted the fifth plague of Moses, and under the fearful storm of hail which "smote throughout all the land of Egypt, all that was in the field, both man and beast."

Although by the law of Moses the Israelites were forbidden to multiply horses, and expressly commanded not to return to Egypt for that purpose, we find that King Solomon disobeyed the command, and in his reign, for the first time in the history of Israel, we hear of the importation and use of horses, that King having purchased horses for 1,400 chariots and 12,000 troopers. Previous to this time, we argue from various passages, that infantry constituted the whole strength of the hosts of Israel, that oxen were almost entirely used for agricultural purposes, asses and mules for journeying from place to place. From the Hyksos or Scythian nomachs, it is probable that all the nations surrounding Israel obtained horses, not long after they were furnished to the Egyptians, for King David, in the Psalms, constantly speaks of horsemen as among the number of his pagan enemies, and in the time of his grandson Rehoboam, Shishak, the King of Egypt, came up to war against Jerusalem with 1,200 chariots and 30,000 horsemen, and among them are enumerated some tribes from the Eastern bank of the Red Sea. It is a fact worthy of notice, that though we find the sculptured resemblances of horses and chariots without number on the monuments of Egypt, employed both in military and domestic uses, there is but one known instance of a mounted Egyptian; the sculptures show the Egyptian horse to have been of a very high bred race, the eye is fiery and prominent; the head small and beautifully set on; the neck arched, the body well rounded; the legs clean and the tail with a fine curve, long and flowing; the action is depicted as spirited, giving an idea of swiftness and courage. The horse was not a sacred animal among the Egyptians; no portion of its body has even been found mummified, and there are very few instances of its figure being found among the hieroglyphics.

In the most ancient annals of India, dating from a period contemporaneous with that of Moses, horses are mentioned, and we know that the sacrifice of a horse even at this period, was one of the most awful solemnities attending the worship of the Goddess Kali. And in the Mahabarata, an old Indian heroic poem, dating back certainly not less than the 6th century before the Christian era, and recording the first great military religious invasion of India, in the enumeration of the corps of armies both chariots and cavalry are mentioned, and this was a northern invasion. The conclusion therefore is that the original seat of the horse was neither in the plains of the Nile, nor in those of Hindostan, nor in Syria, or Arabia, but in the Centre of Asia, whence at various periods of the world's history, of many of which we have now not even the tradition, radiated eastward, westward and southward tribes of Nomad wanderers, the first tamers of the horse to bit and bridle, the rapidity of whose movements and conquests could never have been effected without such an animal, and in whose country both it and the ass existed in a wild state.

And here we may take a glance at another race of mounted warriors, a people of antiquity so distant, that even those whom we call the Antients, placed them back in the heroic or fabulous ages, and attributed to them a wondrous origin and still more wondrous form; I mean the Centaurs, depicted by the poets and sculptors of old as half-man and half-horse, the portions of the two beings constituting a distinct whole. At the bottom of every fable there is generally a fact, and the fact would appear to be, that at some very remote period, or as it may be poetically said in the old heroic days, when demigods performed prodigies on the earth, some wandering tribe of northern horsemen, more adventurous than their fellows, pushed across from Central Asia towards the Black Sea, passed to the northward of it, and crossing the Danube, fell upon Thrace and Thessaly, in which country they established themselves; and for many centuries after, the Thessalian horsemen were among the most renowned in the world. The Pelasgian race then inhabiting these countries, either had no horses or very indifferent ones, not fit for military uses; and the Centaurs were probably the first horsemen they had seen. And as to the ignorant everything unknown is a wonder, they invented the fable, which gave scope to the genius of Phidias, and to these times and our own country the friezes of the Parthenon. The Pelasgians were not more surprised at the extraordinary appearance of their Scythian invaders, than the Mexican Indians were at that of the Conquistador Cortez, and his iron-clad troopers. If, as many ethnologists suppose, even at this early time, a part of the Centaurs separated from the others at the Carpathian chain and pushed onwards to the Baltic, we should at once have a clue to the first arrival of that race in Northern Europe, variously denominated Asia, Gotha, Scythians, Scandinavians or Teutons, a part of whom at a period much nearer our own time, invaded India, but were routed and expelled by Vikia-Maditya, King of Avanti, about 56 years before the Christian era, and who recoiling, carried with them many of the Hindoo religious elements, thus accounting for the horsemen gods, the horse sacrifices, and the mixture of Sanscrit words in the language of the Scandinavians.

The invasion of Thessaly by the Scythian Centaurs, synchronous as I observed before with the heroic age of Greece, nearly so with the expulsion of the Hyksos by Thothmes, with the invasion of Asia by Ramses the Great, and of India by other Scythic hordes, sufficiently marks the periods of great movements through the whole East, and of the general appearance of horses, chariots and horsemen.

I alluded in the earlier part of this lecture to certain philological reasons for believing that Central Asia was peculiarly the land of the indigenous horse. Philology means an inquiry into the origin and construction of language, and in the work of a very celebrated naturalist, we find a most elaborate argument to prove that by a strict enquiry into the names bestowed upon the horse in the most ancient known languages, much light may be thrown both on its primitive seat and period of domestication, and here perhaps will be the proper place to give you the substance of his statements. In Hebrew, the oldest of the Semitic languages now studied, many terms are applied to the horse and its congener, the ass; of these, if we take the words *pra*, *para*, *pered* and *perdah*, to mean an ass, or mule, or more properly any beast to ride on, and compare them with the words *pares*, horses, and *parasim*, Persians or Parthians, that is, horsemen, we see that the original root of the word must be sought for farther east, and that it belongs to the language of a nation of cavalry; and in a secondary sense, an exalted people—that it is in reality a word of Zendic or Sanscrit origin, probably allied in dialect with the Moso-Gothic or Teutonic words *pherd*, *perd* and *paert*, which word is also the root of Latin word *ferro*, to carry, *phra* or *pher*, literally meaning the "*car-borne*," the "*chariot-rider*." We may therefore suspect that these, with many other words of Scythic or Indo-German origin, to be found in Arabic and Hebrew, and other Semitic languages, were borrowed from the horsemen invaders of Egypt and Arabia. It is the same word that is one of the titles of the Sun-God—the charioteer or image of glory and beauty; and in the Scandinavian mythology is synonymous with *freya*, or beauty and pre-eminence. In Babylonish we have the words *ninus* and *ninnus*, and in the Greek, *Ginnus* from an old Asiatic root always meaning a young foal; and in Persia or Parthian we have *pful*, a horse, or a sun-beam—or a horse consecrated to the sun—now one of the Centaur Scythians, whom we have spoken of, was named, Pholus, which seems to be identified with this word *pful*, —*asp*, is another Parthian name of the horse, and this word and pful were both applied as epithets to a long line of Kings and Princes, and in many Greek authors we find the names of Aspii and Arimaspii horsemen, and mountain horsemen, applied to two very ancient nations of Central Asia, another strong proof that it was the original habitat of the horse. Whatever the term may be, the original idea or root seems always to have a reference to conveyance, and is ever associated with elevation, grandeur and velocity. In the Arabic languages alone there are some hundreds of words of Scythian or Northern Asiatic derivation,—most likely derived from an unknown parent stock in Zend, and closely allied to Gothic and Sanscrit. The Indo Sacæ, and Indo-Germani, had long previously gone south, before, at a much later period they removed westward, and consequently their passage through Arabia or the adjacent countries bordering on the Western Caucasian range would have had but little effect on any Semitic languages. Every expression that we find points to the far East as the land of horses, and horsemen; that land being distant from Arabia, as the Lord threatens the Israelites that he would bring on them "a nation from afar, from the end of the earth, *as swift* as the eagle flieth." And it is moreover distinctly said, "a nation whose tongue thou shalt not understand." Who then so likely to have been the means of ingrafting as it were these words of Northern origin on the Arabic and other Semitic languages, as the giant tribes of Scythian nomads, in the far off mythological periods, or the later Hykscs, the Shepherd Kings? In the Sanscrit languages, among the old names of the horse we find none at all distinctly sounding *pra* or *perd*, the epithets being *aswa* and *turanga*—the former of these being most probably the root of *asp*, and the other of *turan*, the land of the swift, the ancient appellation of Bokhara, significantly denominated the "Highland of God," or the valley of the Jaxartes, a river in the Hindu mythology, always represented as issuing from a horse's mouth, another certain indication of the quarter whence horses became known to Southern Asia. It is believed that both *asp* and *aswa* are derived from some still older word, which is also most probably the root of the Greek *hippos* and the Latin, *equus*, by Pelasgian modifications, as are also the Finnic words *uppo* and *upping* so commonly met with in Norway and Sweden. A similar slight change marks the Hebrew word *ramach* and the Celtic-Scythic word *march*, a horse or mare.

The Turkish name for a horse is derived from a word signifying red or bay, and this very word bay, in Latin *badius*, and in Teutonic bayard, may be of Arabic origin, when *beya* means the same animal, or this may be perhaps merely a coincidence, from the Arabic, Pelasgic and Teutonic, having the same root. Therefore, seeing that the root or original of all these words, in whatever language they occur, may still be traced to a Scythic origin or language. It is concluded from this philosophical fact, that the horse came to Egypt and the adjacent countries, as well as into Hindostan, already domesticated, from the north-east, and that is the reason why we find no mention of it till the time of Joseph. In Asia we find that the northern half of the whole male population, and even sometimes the female population have used the saddle ever since human tradition began; while in the southern half the better classes only, since the commencement of profane history, have used the horse, and to this day many of the wandering tribes of Southern Asia prefer the camel to the horse. There is no evidence whatever, written or traditionary, that there ever were wild horses in any part of Arabia, every portion of the country has been accessible from the earliest periods, and visited by wandering tribes, and there is no where any district or cover fit for the propagation of horses in a wild state. It is therefore fair to conclude that the horse was unknown in Arabia, until conquerors of the giant race, Scythians or Hyksos, brought them from Upper Asia, and that these hordes and their animals were incorporated with the original inhabitants, or that the horses were left—and many words of the language, when the riders had perished or were expelled. Ezekiel seems to allude to such an invasion as this when he speaks of a "King of Kings" from the north, with horses, and with chariots and horsemen. "A King of Kings," literally Changan, the name now given by many Tartar tribes to their chiefs.

(To be Continued.)

Extracts from Exhibition Lectures.

Candles.—The manufacture of candles has recently been much improved by the aid of Chemistry. Tallow candles, or their more expensive substitute, wax, were generally used till within the last twenty years. The tallow itself was long very impure, containing cellular tissue, which was only partially removed in the form of a scum, known as "cracklings." This impurity rendered the light unsteady, and obstructed the wick. The old method of purification still largely used in this country, though superseded on the continent and in Dublin, whence such good tallow candles were exhibited, has been displaced by a process of treating with sulphuric acid the tallow melted by steam. Much of the smell is thus removed, and a larger amount of a purer tallow is obtained. The researches of Chevreul had shown that fats consist of fatty acids, combined with a kind of sugar named glycerin, which it was important to remove; this glycerin, removed in candle-making, is now used as liniments in cutaneous affections, and is employed as a remedy in deafness and rheumatism. By boiling with lime, an insoluble soap is formed, while the glycerin remains dissolved in the water. This lime-soap, decomposed by a stronger acid, yields the fatty acids in a purer state. But there are generally two solid acids mixed with a fluid one; and the latter is easily removed by pressure, the solid fats remaining. The solid acids are made into the beautiful candles erroneously called "stearine." The solid acids, crystallizing rapidly, were ill adapted for candles; but the introduction of arsenic in small quantity prevented the crystallization. The public were justly alarmed at this dangerous practice, and the manufacture was threatened with extinction, when it was found that a small per-centage of wax produced the same effect, and that large crystals might even be prevented by a careful regulation of the temperature. This evil was therefore avoided; but a more serious one arose. The ashes of the wicks, becoming heated, cause the fatty acids to splutter: and this was a grave inconvenience. These ashes, however, form a fusible glass with borax; so the wicks are dipped into a solution of this salt, and the difficulty removed; a salt of bismuth is also used for this purpose. Snuffers, however, are always troublesome, and a self-snuffing candle was an important want. Chemists have told us that flame is hollow, its centre containing no oxygen capable of supporting combustion; and the wick, being in the hollow part, excluded from the air by its fiery prison, is charred, and diminishes the light. If the wick could be made to turn outwards, it would reach the exterior air and be consumed, whilst the glass formed by the action of the borax on its ashes would also be removed. This beautiful scientific fact was attained by the introduction of plaited and twisted wicks, the tension of the threads forcing the wick to curl outwards to the exterior of the flame, where it is rapidly burned.

Another great improvement now took place. In preparing the commercial stearine from palm-oil or tallow, it is essential to remove the glycerin, and this had been accomplished by saponifying them with alkalies. Sulphuric acid, acting on fats, unites with the oily acids and with glycerin; the former compounds are decomposed by water and become insoluble, while the latter, from being soluble, is removed; the oily acids blackened with the destroyed organic impurities, are now distilled, and it is found that a jet of steam, heated somewhat in the manner of the hot blast, aids their distillation, the fatty acids passing over in a comparatively pure form, while the residual black resinous matter is made into black sealing-wax. Candles may now be made from the distilled fatty acids at once, or they may be pressed to remove the oleic acids.

The oleic acid, both from this mode of manufacture and from that by alkaline saponification, is principally exported to France, where it is made into a hard soap. In this country we have yet to acquire the method of doing this. The excellence of the acid saponification is, that it is applicable to palm oil and to the most impure and fœtid fats; by its means the finest candles may be made from the waste of the glue-maker and from the oily residues obtained by the decomposition of the waste lyes of the woollen manufacturer and the bleacher. As the first beautiful process of saponification sprang from the abstract researches of Chevreul, so has the last elegant method arisen from the scientific investigations of Frémy, although both of them have been reduced to practice, with many improvements, by the manufacturers themselves. The importance of the manufacture may be understood when I state that one company (Price's Candle Company) possesses cocoa-nut plantations in Ceylon, and employs eight hundred workmen in its five manufactories in London, using a capital of nearly half a million, and dividing profits to the extent of £40,000 per annum.

Chemistry has not yet done so much for the manufacture of wax candles as might have been anticipated. Wax is still bleached by exposure to air and light, and the operation has been hastened more by mechanical than by chemical contrivances; the bleaching of wax is a tedious and often a difficult process, and demands greater attention from chemists than it has received; the Brazilian mahogany-coloured wax, produced by a black bee hiving under ground, has not yet been bleached by the sun, and might be imported in considerable quantity if Chemistry offered means for removing its colour. I do not allude to what Chemistry offers to do, but it would appear that paraffin and oil from coal, and possibly from peat, may dispense, to a certain extent, with the necessity for sperm-whale fishing.

Coal-gas.—The manufacture of coal-gas is an admirable example of the benefits conferred by Chemistry in all the three divisions of its uses; for it not only economized human power and time, but it has utilized all the products employed in removing its impurities. Coal-gas was only introduced to use at the beginning of this century, and the public prejudice which had to be overcome, and the difficulties to be surmounted in its actual manufacture, may still be remembered by many of my hearers. It was no mean innovation to replace tallow candles and oil lamps by an air streaming through pipes, but the difficulties attending its purification from noxious ingredients appeared even more insuperable than to reconcile the public to the innovation: the gas had an insupportably fœtid odour, and certainly injured health when burned; it discoloured the curtains, tarnished the metals, eat off the backs of books, and covered everything with its fuming smoke. It required a man of courage, as indomitable as Winsor, its great advocate, to persuade the public to continue its use until means were found for the removal of these noxious qualities. Here Chemistry, itself the father of the manufacture, was called in consultation. The impurities in the gas are sulphuretted hydrogen, which tarnished the metals, and with sulphuret of carbon produced sulphureous fumes; ammoniacal compounds, which changed the colour of dyes and acted on leather; tarry vapours, which caused the deposition of soot; and all these had to be removed. The ammonia and the tar were partially condensed in tubes kept cool, the sulphuretted hydrogen and carbonic acid were removed by lime, and the ammonia by washing the gas with water. This last operation was the least effective, and new substitutes had to be devised, one of which I may mention; superphosphate of lime, consisting of bones dissolved in sulphuric acid, only required ammonia to make it a powerful and excellent manure; trays of this superphosphate were therefore placed in a chamber through which the gas passed, and thus the ammonia was removed, while the phosphate became enriched. A new method is now extensively employed, and shows the tendency to simplification resulting from discovery. By this method almost all the conditions of purification are satisfied by one process; the gas, after cooling, is at once taken into a chamber containing carbonate of lime and sulphate of iron; these, reacting upon each other, produce oxide of iron and sulphate of lime. The gas, streaming through this mixture, gives up its sulphuretted hydrogen to the oxide of iron, while the carbonate of ammonia. decomposing the lime salt, forms sulphate of ammonia and carbonate of lime, the lime thus being reconverted to its original state; the gas before before being passed into this mixture is occasionally led through chloride of calcium in order to aid the removal of the ammoniacal salt. When the mixture has done its work it is exposed to air, and the sulphide of iron absorbing oxygen is converted into a basic sulphate of iron; hence the mixture is similar in its purifying character, except that it contains sulphate of ammonia, which may be washed out and preserved, while the residue is employed over and over again. By this elegant process the noxious sulphur compounds are utilized in the fabrication of sulphate of ammonia, and the mixture seems never weary of performing its duty; hence not only is the purification performed at one process, but the noxious ingredients are converted into compounds of much value. The waste and badly-smelling products of gas-making appeared almost too bad and fœtid for utilization, and yet every one of them, Chemistry, in its thriftiness, has made almost indispensible to human progress; the badly-smelling tar yields benzole, an ethereal body of great solvent powers, well adapted for preparing varnishes, used largely for making oil of bitter almonds, of value for removing grease-spots, and for cleansing soiled white kid gloves. The same tar gives naphtha, so important as a solvent of Indian rubber and gutta percha; similar tar, when made from wood, yields creosote, a powerful preservative of animal matter, and much employed as a medicinal agent. Coal-tar furnishes the chief ingredient of printer's ink, in the form of lamp-black; it substitutes asphalte for pavements; it forms a charcoal when mixed with red-hot clay, that acts as a powerful disinfectant. When the tar is mixed with the coal-dust. formerly wasted in mining operations, it forms by pressure an excellent and compact artificial fuel; the water condensed with the tar, contains much ammonia, readily convertible into sulphate of ammonia, a salt now recognised as being of great importance to agriculture, and employed in many of the arts. Cyanides are also present among the products of distillation, and these are readily converted into the beautiful colour known as Prussian blue. The naphthaline, an enemy to the gas-manufacter by choking the pipes, may be made into a beautiful red colouring matter, closely resembling that from madder. This, by its transformation, promises an important, hitherto not yet realised useful product. Coal, when distilled at a lower temperature than that required to form gas, produces an oil containing paraffin, largely used as an antifrictional oil for light machinery.

In the isolated cases of manufactures, adduced as types of the importance of chemical appliances to industry, I have referred to general subjects rather than to individual objects in the Exhibition; because these Lectures ought, in obedience to the desire of their Royal suggester, to be indications of consequences rather than references to special excellencies. The illustrations have been restricted to Chemistry, not that I unduly exalt its importance, but that we are wisely instructed to confine our attention to the branch of knowledge most familiar to us. All these instances, however, are real consequential supports of a text which has already been discussed in its general bearings in another Lecture.* The text was this,—that the progress of abstract science is of extreme importance to a nation depending upon its manufactures. It is only the overflowings of Science, arising from the very fulness of its measure, that benefit industry. When water falls from a higher to a lower point, it, to a certain extent, increases the velocity of the rotation of the earth, and the sum of the increments of the velocity of all falling waters would soon be sensible, were it not that the sun, lapping them up, restores them to their sources, and by removing them farther from the centre, compensates for the increased velocity given in one locality; while at the same time they fertilize the lands on which they fall. So is it with Science and Industry. The overflowings of abstract Science give their first impulse to the country producing them; but the Sun of knowledge soon raises and distributes them to all lands, which receive benefit in just so far as the ground is prepared for their fertilizing influence. The discoverer of abstract laws, however apparently remote from practice, is the real benefactor to his kind; in reality, far more so than he who applies them directly to industry. Yet in our Mammon-worship we adore the golden calf, and do not see its real creator. It is abstract and not practical Science that is the life and soul of Industry; practical appliances are the organs through which the God-born truths pass for the sustenance of its general frame. The cultivators of abstract Science, the searchers after truth, for eternal truth's own sake, are —to borrow a simile, I believe of Canning—the horses of the chariot of industry; those who usefully apply the truths are the harness by which the motion is communicated to the chariot. But is the chariot drawn by the horses or the harness? Truth to say, in this country of ours, and mark you well, in no other country in Europe,—we honour the harness, but neglect the horses. It is the harness that is gilt; the hard-working horses too often receive but meagre fare. Now, in all this, I tell you a living truth; one far more connected with the actual material progress of our nation than you may be aware of. The published opinions of Babbage and Herschel, men who have a right to pronounce judgment on this subject, assure us that England is rapidly declining in Science. It is most important that we should ascertain the real cause of this decline. The cause would appear to be, that we chiefly honour those who are useful in our time and generation; that our eyes are too eagerly bent upon the golden prize, for which we are all running; and that we can only afford to throw a kind of theoretical squint of recognition on those men, who are looking for sublime truths, careless as to whether they will have any immediate effect on industrial progress. And yet it is these very men that give strength to the sinews of a future generation, enabling it to keep its place in the industrial struggle of nations. Do not misunderstand me. Science never looks so beautiful as when she aids man to increase his resources and comforts; but the dove would not have brought the olive-branch to the ark of man's hopes unless she had been able to take a higher and a longer flight than that embraced in the tree whence she came.

It is no new truth that both abstract Science and Art should have a position intimately allied with, but still thoroughly independent of, Industry. I read mythology wrongly, unless this is strongly shadowed out in the history of the gods. Vulcan, the god of Industry, wooed Minerva with a passionate love, but the chaste goddess never married. keeping always independent, although no celestial ever showered so many benefits on the peaceful arts. Artistic beauty, in the person of Venus, was really

* "On the National Importance of Studying Abstract Science with a view to the Healthy Progress of Industry." By Lyon Playfair, C.B.F.R.S.—H. M. Stationery Office.

wedded to Vulcan, but this ill-assorted union was not a happy one, and Venus often repeated the alliance.

Take the case of any philosopher, the most separate from human sympathies and enjoyments, and you will find that from him, though not through him, have sprung numerous appliances for their gratification. The very impersonification of abstract Science was Cavendish, as described by his biographer,* although fortunately for the world, such total abstraction from human sympathies does not frequently exist. "He did not love; he did not hate; he did not hope; he did not fear; he did not worship as others do. He separated himself from his fellow-men, and apparently from God. There was nothing earnest, enthusiastic heroic, or chivalrous in his nature, and as little was there any thing mean, grovelling, or ignoble. He was almost passionless * * * An intellectual head thinking, a pair of wonderfully acute eyes observing, and a pair of very skilful hands experimenting or recording, are all that I realize in reading his memorials. His brain seems to have been a calculating-engine; his eyes inlets of vision, not fountains of tears; his hands instruments of manipulation, which never trembled with emotion, or never clasped together in adoration, thanksgiving, or despair; his heart only an anatomical organ, necessary for the circulation of blood." Yet this man, destitute of passions and of sympathies, who during his body life, poured down light upon, without warming, the world—has by his mind, which still lives, conferred more real material benefit upon industry than any of the so-termed "practical" men who have succeeded him. His discovery of the composition of water has given to industry a vitality and an intelligence, the effects of which it would be difficult to exaggerate.

I have shown in my former Lecture, that a rapid transition is taking place in Industry; that the raw material, formerly our capital advantage over other nations, is gradually being equalized in price, and made available to all by the improvements in locomotion; and that industry must in future be supported, not by a competition of local advantages, but by a competition of intellect. All European nations, except England, have recognized this fact; their thinking men have proclaimed it; their governments have adopted it as a principle of state; and every town has now its schools, in which are taught the scientific principles involved in manufactures, while each metropolis rejoices in an Industrial University, teaching how to use the alphabet of Science in reading Manufactures aright. Were there any effects observed in the Exhibition from this intellectual training of their industrial population? The official reserve, necessarily imposed upon me as the Commissioner appointed to aid the Juries, need exist no longer, and from my personal conviction, I answer without qualification, in the affirmative. The result of the Exhibition was one that England may well be startled at. Wherever—and that implies in almost every manufacture—Science and Art was involved as an element of progress, we saw, as an inevitable law, that the nation which most cultivated them was in the ascendant. Our manufacturers were justly astonished at seeing most of the foreign countries rapidly approaching and sometimes excelling us in manufactures, our own by hereditary and traditional right. Though certainly very superior in our common cutlery, we could not claim decided superiority in that applied to surgical instruments; and were beaten in some kind of edgetools. Neither our swords nor our guns were left with an unquestioned victory. In our plate-glass, my own opinion—and I am sure that of many others—is, that if we were not beaten by Belgium we certainly were by France. In flint-glass, our ancient *prestige* was left very doubtful, and the only important discoveries in this manufacture were not those shown on the English side. Belgium, which has deprived us of so much of our American trade in woollen manufactures, found herself approached by competitors hitherto almost unknown; for Russia had risen to an eminence in this branch and the German wollens did not shame their birthplace. In silversmith work we had introduced a large number of foreign workmen as modellers and designers; but, nevertheless, we met with worthy competitors. In calico-printing and paper-staining our designs looked woderfully French; whilst our colours, though generally as brilliant in themselves, did not appear to nearly so much advantage, from a want of harmony in their arrangement. In earthenware we were masters, as of old; but in china and in porcelain our general excellence was stoutly denied; although individual excellencies were very apparent. In hardware we maintained our superiority, but were manifestly surprised at the rapid advances making by many other nations. Do not let us nourish our national vanity by fondly congratulating ourselves that, as on the whole we were successful, we had little to fear. I believe this is not the opinion of most candid and intelligent observers. It is a grave matter for reflection, whether the Exhibition did not show very clearly and distinctly that the rate of industrial advance of many European nations, even of those who were obviously in our rear, was at a greater rate than our own; and if it were so, as I believe it to have been, it does not require much acumen to perceive that in a long race the fastest-sailing ships will win, even though they are for a time behind. The Exhibition will have produced infinite good, if we are compelled as a nation to acknowledge this truth. The Roman empire fell rapidly, because, nourishing its national vanity, it refused the lessons of defeat, and construed them into victories. All the visitors, both foreign and British, were agreed upon one point, that, whichever might be the first of the exhibiting nations, regarding which there were many opinions, that certainly our great rival, France, was the second. Let us hope that in this there is no historical parallel. After the battle of Salamis the generals, though claiming for each other the first consideration as to generalship, unanimously admited that Themistocles deserved the second; and the world ever since, as Smith remarks, has accepted this as a proof that Themistocles was, beyond all question, the first general. Let us acknowledge our defeats when they are real, and our English character and energy will make them victories on another occasion. But our great danger is, that in our national vanity, we should exult in our conquests, forgetting our defeats; though I have much confidence that the truthfulness of our nation will save us from this peril. A competition in Industry must, in in an advanced stage of civilization, be a competition of intellect. The influence of capital may purchase you for a time foreign talent. Our Manchester calico-printers may, and do keep foreign designers in France at liberal salaries. Our glass works may, and do, buy foreign science to aid them in their management. Our potteries may, and do, use foreign talent both in management and design. Our silversmiths and diamond-setters may, and do, depend much upon foreign talent in art and foreign skill in execution; but is all this not a suicidal policy, which must have a termination, not for the individual manufacturer, who wisely buys the talent wherever he can get it, but for the nation, which, careless of the education of her sons, sends our capital abroad as a premium to that intellectual progress which, in our present apathy, is our greatest danger?

Notice of an Indian Burying Ground.

BY EDWARD VAN COURTLAND, BYTOWN.

In the summer of the year 1843, whilst some workmen were engaged in digging sand for the mortar used in the construction of the piers of the wire suspension bridge at Bytown, suddenly came in contact with a number of human bones, and having been apprized of the circumstance, I lost no time in proceeding to the scene of their operations. A very little investigation served

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* "Life of Cavendish," by Dr. Wilson, p. 185.

to shew they had discovered an Indian burial-place. Nothing possibly could have been more happily chosen for sepulture than the spot in question, situated on a projecting point of land directly in rear of their encampment, at a carrying place, and about half a mile below the mighty cataract of the Chaudière; it at once demonstrated a fact handed down to us by tradition, that the aborigines were in the habit, when they could, of burying their dead near running waters. The sand where these remains were discovered is of the very purest description, forming a superstratum of many feet thickness at its upper part, and gradually ending in a feathery edge over the fossiliferous limestone which constitutes the bed of the river. The very oldest settlers, including the Patriarch of the Ottawa, the late Philemon Wright, and who had located near by some thirty years before, had never heard of this being a burial-place, although Indians existed in considerable numbers about the locality when he dwelt in the forest; added to this, the fact of a huge pine tree growing directly over one of the graves, was conclusive evidence of its being used as a place of sepulture long ere the white man in his progressive march had desolated the hearths of the untutored savage. The best portion of two whole days was spent by me at the diggings, and the fruits of my research were as follows:—One very large, apparently common grave, containing the vestiges of about twenty bodies, of various ages, a goodly share of them being children, together with portions of the remains of two dogs heads; the confused state in which the bones were found, shewed that no care whatever had been taken in burying the original owners; and a question presented itself, as to whether they might not have all been thrown indiscriminately in one pit at the same time, having fallen victims to some epidemic, or beneath the hands of some other hostile tribe; nothing however, could be detected on the skulls, to indicate that they fell by the tomahawk, but save sundry long bones, a few pelvi, and six perfect skulls, the remainder crumbled into dust on exposure to the air. In every instance the bones were deeply coloured from the Red Hematite which the aborigines used in painting, or rather bedaubing their bodies, falling in the form of a deposit on them when the flesh had become corrupted. This material appears to have been very avishly applied from the fact of the sand which filled the crania being entirely coloured by it. A few implements and weapons of the very rudest description were discovered, to wit:—1st, a piece of Gneiss about two feet long, tapering, and evidently intended as a sort of war club; it is in size and shape not unlike a policeman's staff. 2nd, a stone gouge, very rudely constructed of fossiliferous limestone, it is about ten inches long, and contains a fossil leptena on one of its edges; it was used, as I lately learned from an Iroquois Chief, for skinning the Beaver. 3rd, a stone hatchet of the same material. 4th, a sandstone boulder weighing about four pounds; it was found lying on the sternum of a Chief of gigantic stature, who was buried apart from the others, and who had been walled round with great care. The boulder in question is completely circular, and much in the shape of a large ship biscuit before it is stamped or placed in the oven; its use was, after being sewed in a skin bag, to serve as a corselet, and protect the wearer against the arrows of an adversary. In every instance the teeth were perfect, and not one unsound one was to be detected, at the same time they were all well worn down by trituration, it being a well-known fact that in Council the Indians are in the habit of using their lower jaw like a ruminating animal, which fully accounts for the peculiarity. There were no arrow heads or other weapons discovered.

Canadian Institute.

At the Sixth Ordinary Meeting of the Canadian Institute, on Saturday, January 22nd, the following gentlemen were duly elected members of the Institute:

Christopher Robinson ....Toronto,

W. A. Baldwin...........................Toronto,
F. Perkins.............................. "
J. G. Howard............................ "
A. W. Simpson, G. H. Murray, } Junior Members.............. "

Professor Hind read a paper on the Geology of Toronto, illustrated by numerous specimens of fossils collected in the immediate neighbourhood of the city.

It was moved by Col. O'Brien, and seconded by Dr. Badgley and resolved:

"That the Council be recommended to take into their consideration the desirability, if not the necessity of obtaining a building not only fit for the requirement of the Institution as to its meetings, but also to the safe deposit of its specimens, and also to take such steps towards obtaining means as they may consider desirable."

SEVENTH ORDINARY MEETING, JANUARY 29TH

The following gentlemen were duly elected members of the Institute:

Peter McGill McCutcheon.....................Toronto.
Maurice Baldwin, Junior Member................ "

Professor Croft signified his intention of presenting to the Institute a variety of Ornithological and Mineralogical specimens, as soon as proper cases were provided for their reception.

It was then moved by Professor Croft, and seconded by Prof. Cherriman, and resolved:

"That a Private Subscription be entered into by the members of this Institute, for the purpose of purchasing Glass Cases and other conveniences for the Museum.

The sum of £6 10s. was immediately subscribed by the members present.

Professor Cherriman read a paper on "Decimal Currency," which he was requested to publish in the Canadian Journal.

EIGHTH ORDINARY MEETING, FEBRUARY 5TH.

The following gentlemen were duly elected members of the Institute:

James Reekie, C. E.........................Quebec.
Hon. W. B. Richards........................ "
Samuel Stratford, M. D......................Toronto.
J. G. Valentine, C. E.......................Niagara.
E. Gainsborough Widnall, Junior Member........Toronto.
Lewis Moffatt.............................. "
J. G. Worts................................ "
H. P. Savigny, P. L. S......................Barrie.

The President of the Institute read a paper on the "Windrose of Toronto."

NINTH ORDINARY MEETING, FEBRUARY 12TH.

The following gentlemen were duly elected members of the Institute:

John Arnold..............................Toronto.
Henry Moyle..............................Bradford.
William Sladden..........................Toronto.
John Perram..............................Tecumseth.

Donations by the President were then announced, of a Robe made from the skin of a White Carriboo, from the barren grounds, District of Athabasca, and of some Fossil Shells (*auricula*) from St. Helena.

Also, donations by W. E. Logan, Esq., F. R. S., & G. S., late President of the Institute, of the Official Illustrated Catalogue of the Great Exhibition, and Hunt's Hand Book of the Great Exhibition.

Mr. Hirschfelder read a paper on Oriental Literature.

REVIEWS.

TORONTO HARBOUR.

1. *A Report by Walter Shanley, Esq., C.E. Toronto, January 2nd*, 1853.
2. *A Report by Sir R. Bonycastle*, 1843.
3. *A Paper read by Sandford Fleming, Esq., C.E., before the Canadian Institute.* Toronto, *June* 1*st*, 1850.
4. *A Supplementary Paper read by S. Fleming before the Canadian Institute. Toronto, March* 22, 1851.
5. *A Letter (published in "The Patriot,") signed "Kivas Tully." Toronto, February 10th*, 1853.

"In a multitude of Councillors there is (or ought to be) wisdom." Mr. Shanley's Report, lately published, has had the effect of directing general attention to the condition of the Toronto Harbour, upon the efficient maintenance of which undoubtedly depends the Commercial character and prosperity of the city. The subject is one, therefore, of very general interest; and as, in an engineering view, it is moreover admitted to be one of very great difficulty and danger, it is of importance that opinions given authoritatively should be subjected to rigid scrutiny and frank reviewal. If we should find it necessary to dissent from the views of the authors of the above papers, they must remember that those views have by their own acts become public property, and that the higher the source from which they have emanated, the more worthy are they of criticism, even though it be adverse. Everybody who knows Toronto, knows the Peninsula by which its bay is nearly enclosed. Approach the city by water, from what point he may, the stranger's eye rests upon this curiously shaped spur; and as he quickly discerns its sheltering properties, and to it attributes the excellence of the haven, so charmed is he by the stillness of the waters within, and so satisfied is his mind by the contemplation of an evident security, that he generally fails to lament the narrowness of the entrance, or to speculate upon the theory of that formation which is the cause of it. Some there are, of course, who, like Mr. Shanley, "standing on the deck of a steamer," or "looking from the shore," have noticed "the plainly defined outlines of the bar," which, alas! it requires not "the eye of an engineer" to discover. Nay, some grumbling and visionary alarmists have been looking at it these twenty years past; and although indulging in fearful predictions in regard to its future, (in which they have been supported by engineers, surveyors, et hoc genus omne, from the time of General Simcoe to the present day) have failed to obtain a hearing, far less to induce a belief. "Truly," have exclaimed these disappointed savans "men are no prophets in their own country!" and therefore, when Mr. Shanley asserts that his acquaintance with the locality has been "short," and that his knowledge of it is that of "a stranger," he takes his course with the acuteness common to his countrymen, and "goes in to win" on the acceptation of the same old proverb, extended to a belief in prophets from afar.

Before attempting to prescribe a remedy, engineers, like physicians, generally endeavour to ascertain the cause of the evil; and having satisfied themselves that the root and manner of its action have been discovered, they proceed to apply those preventive or remedial measures which they believe to be suited to the case; but of course if the premises be erroneous the deduction will be false, and the applications made upon it will very probably be unsuccessful.

This gives great importance to the inquiry, "How has this peninsula been formed, and to what causes may the prolongation of the bar at its western extremity be ascribed?" Upon a clear and satisfactory determination of these points probably depends the efficiency of the remedial measures; in its absence any measures so intended can but be experimental, and may be worse than useless.

Prior to 1850, four different theories of formation had been proposed, which we find thus enumerated in Mr. Fleming's paper of that year:—

1. That the Peninsula is an accumulation of drift, carried across the lake by the current of the Niagara River.

2. That it has been formed, and that the shoal at the entrance of the harbour is now in process of extension, by the influence of the opposing currents of the Don, and the more westerly rivers, *in contact*, and the deposition of matter on the neutral line between them.

3. That it is a ledge of the rock underlying Toronto and the lake, forming a check for the deposition of, and now covered with alluvial matter.

4. That it is a deposition of the Tertiary period. And,

5. That it is jointly a delta of the Don, and a drift from the eastward.

The first of these propositions may briefly be dismissed as untenable: the third is at variance with the general Geological features of the locality, and has been disproved by investigation; and the fourth is that suggested by Sir Richard Bonycastle, who states his belief "that the Peninsula is one of the many ridges deposited at the bottom of a vast lake, which existed before the present Ontario and Erie were formed out of its drainage," "and that it had probably not changed its form or character since it emerged from the waters." Now, by reference to the papers and charts in the possession of the Canadian Institute, we find, that since Bonycastle wrote, not only has the general outline of the Peninsula been very considerably altered and extended, but that at one particular point an area of upwards of thirty acres has been added to that previously within the shore line; and as this recent addition is in geological character a perfect fac-simile of the portions anterior to it, we may infer that both are due to the same causes, and traceable to the same source, and therefore that the Peninsula is a formation of the present epoch, and not a diluvian deposition.

The second proposition is that which has found a supporter in Mr. Shanley, who after stating that "*on looking from the shore, when the* waters were beginning to be ruffled by a coming gale, or subsiding into a calm after one, he has frequently viewed, with an engineer's eye, the plainly defined outline of the bar, indicated by a white muddy streak, whilst the waters on either side of it were clear and uncoloured,"—proceeds to record his opinion that "the sandbank is simply the accumulation of the deposit brought down year after year by the Humber, the Etobicoke, the Credit, the Sixteen, and other streams discharging into the lake above this city; all of which are subject to great and sudden freshets, the discoloration of their waters at such periods indicating that they are surcharged with the debris of the regions they have traversed, and which, held for a time in suspension in the lake, is by the prevalence of south-westerly winds, drifted down and finally precipitated along the 'peninsula' which forms the southern shore of the bay, and over the still submerged bar, which is fast becoming its Western one."

"To the effect," he continues, "of the counter currents, caused by the prevailing winds down the lake, and the River Don, discharging its waters in a contrary direction, I believe to be due the origin of the Peninsula which encloses the bay, the precipitation of the suspended matter naturally taking place on the neutral line between the conflicting currents; and so well assured do I feel that this vast accumulation of deposit is mainly attributable to the action of the above-named streams, that it would surprise me much if a scientific examination of the bar should fail to prove the particles entering into its composition to be representatives in minature of the same geological formation as obtains along and below the Flamborough Heights."

In this proposition, then, Mr. Shanley first declares that "when the waters are beginning to be ruffled by a coming gale, or subsiding into a calm after one, "the bar is denoted by a white muddy streak," with the water on either side of it *clear and uncoloured.*" Now we presume, that as "the discoloration of the waters of the Humber and other westerly streams "indicates that they are surcharged with the debris of the regions they have traversed," the absence of this discoloration on the margins of the bar (and especially under the circumstances stated) would appear to denote that such debris has not been carried thence, and by those waters, for how could "the waters on either side" remain, even during a gale, in a translucent state, if at the same time they were the vehicle of transportation for the discolouring matter referred to, and in other places so apparent? But in the process of such a transportation, a distance varying from *five to twenty miles*, with a depth of water varying from *sixty to one hundred feet*, are involved; and it seems very questionable, if it may not be stated as an impossibility, that the materials of which the Peninsula is formed (*sand and gravel*) could for such a distance, and over such a depth of comparatively still waters, be "held in suspension, and drifted down" to their present position. Were the deposit of an argillaceous nature, and did the winds prevail from the south-west, there might be some grounds for such a supposition; but as neither of these is consistent with fact, we conceive there are none.

Again, in a subsequent paragraph (and after having attributed the bar to "the effect of *the counter currents* of the lake and the River Don") Mr. Shanley says, whilst the lake and its tributaries are united in blockading the entrance of the Port, there is a less potent but insidious and patient enemy busy at its Eastern extremity—the River Don." "Doubtless the evils to be apprehended from the action of this stream are *distant and insignificant*; * * * but having more than once heard the opinion expressed, that an effect beneficial to the channel, in aiding to keep it unobstructed, is due to the influx (we presume *efflux* is intended) of the Don water, I wish here to record my dissent from such opinion, being convinced that * * * *the outward currents which do exist at seasons, are to be traced to an entirely different source.*" Now, the Don seems to be a very fickle or very accommodating River. First we have its current conflicting with the lake waters at the bar, *and thus forming it*, and then we have it insidiously retiring to "the eastern extremity of the bay" and "busy" in another service: first, it is described as "discharging its waters "at the bar," in a contrary direction" to that of a south-westerly wind, and immediately afterwards, "the outward currents are attributable to an entirely different source!" Far from attempting to disentangle this mystery, we shall not even essay to determine which "current" of this "conflicting" argument is the true one. Indeed, we are inclined to doubt both, for if the outward current be not due to the Don, it must, we suppose, be due to the wind; and if to the wind, inasmuch as its influence would be common to both currents, simultaneously impelling them in the same direction, there could be no "conflict." A wind driving the Lake waters west, would drive the Bay waters out, and westerly; whilst a wind impelling the Lake waters east, would drive them into the Bay, and thence easterly. We cannot understand the proposition, and should be glad to see it explained.

But it is said that "the conflicting currents" (we mean of the waters, not the argument) result in "a neutral line, where the precipitation of the suspended matter actually takes place." One current, however, that of the Don, has been unceremoniously dismissed to "the eastern extremity of the bay," and the other, and that the most potent, is attributed to the influence of the south-west, which is certainly not the prevailing wind: as surely therefore as the wind changes, the neutral line between the two currents (for we must recall the Don to get the conflict) changes with it, and hence the precipitation is distributed far and wide,—or is chiefly in the line of the prevailing wind, and therefore not where it is said to be.

There are other and very cogent reasons, inducing us to doubt that the peninsula is the deposit of the streams to the westward, or (as Mr. Shanley suggests) "the geological representative in minature of the Flamborough heights." We believe the Peninsula to be, in superior geological formation, the representative of the *Scarborough* heights; and if so, then undoubtedly it is a deposit from *the eastward*, brought, *not* as *Mr. Shanley says*, by the River Don, for that would involve a geographical impossibility, but by the lake waters, under the influence of south-easterly gales. And again, before the commencement of such a deposition as that suggested from the west, the Don, it is fair to infer, must have had a free run into the lake; when therefore it conflicted with a stronger current from the west, it must have been turned easterly; and as the neutral line would of course take the same direction, the deposition would have been easterly also. Now, the current of the Don outwards has been turned westerly, and the deposition, it is admited, has been and still it westerly; it is reasonable to conclude, therefore that the strongest lake currents have been from the east—and if from the east, then undoubtedly the Peninsula cannot be a deposit from the westerly streams. Besides, to suppose that the deposit has been from the west, is to suppose either that the two currents first met at the bar, and that the deposition has been *thence easterly*, or that they met at the eastern limit of the peninsula, and that the deposition has been *thence westerly*, in the teeth of the strongest current: but the former is contrary to fact, and the latter an impossibility: we have therefore to account in some other way for this formation and its progress.

And this brings us to the fifth proposition in Mr. Fleming's list, and to the consideration of his papers named in our heading.

Mr. Fleming contends that the peninsula is jointly a delta of the Don and a drift from the eastward. This theory he has propounded after a very complete, and apparently a very accurate instrumental survey of the bay and the peninsula, including soundings within and without, and sections from various points of the city front, on lines southerly through the bay and peninsula to the lake. He has moreover transferred, from charts of various dates, the form and condition of the peninsula, by which, in connection with his own more recent surveys, he professes to elucidate the manner of its extension, and to these he has appended charts of the other natural harbours of our lakes where, in his opinion, the same agencies have been exercised to a similar result.

Many of our readers will remember the occasion on which these papers were exhibited some two years since. The authorities of the city—the Mayor, and members of the Corporation, the Harbour Commissioners, and others officially interested in the subject, were invited to be present, and some of them did attend the reading of the papers, and the discussions which ensued upon them, in the rooms of the Canadian Institute. We think we are correct in saying, that the general impression then was that Mr. Fleming had succeeded in establishing the truth of his propositions: at any rate it is certain, that the valuable information, which, he had collected, was acknowledged to have given the first practical direction to this important enquiry. Our limits will not permit us to make any very lengthened reference to Mr. Fleming's labors, nor is it necessary, as in combating Mr. Shanley's views, we have in a great measure adopted those of Mr. Fleming. He contends that the groundwork of the peninsula was a delta of the Don, formed on the subsidence of Lake Ontario from a high to its present level, and the consequent scour of the region now represented by its valley:—that this delta has afforded a base for the drift from the highlands of Scarborough, which formerly occupied a much more southerly position than at present; and that under the influence of the south-westerly gales, it has continued to augment, the deposition being westerly, until, in approaching the open waters of the Humber Bay, its course has been turned towards the north.

The direction in which the drift is moved by the waves, is subject, of course, to the direction of the wind; and the quantity moved bears intimate relation to the force of the waves, which with winds of equal velocity are again dependent for their power upon the area which they traverse. Now we know it is beyond dispute, 1st, that the prevailing wind of Lake Ontario mainly affecting its north shore is from the south-east; and 2ndly, that the greatest extent of water over which any wind impinging on the north shore of the lake can traverse, is also south-easterly, so that inasmuch as the formation of the peninsula is identical with that of the Scarborough Heights, and the prevailing and most powerful winds precisely those which would carry the drift thence to the peninsula, we have very strong grounds for concluding that to those influences its formation may be ascribed. But further, if we recur to the principle upon which Mr. Shanley rests his argument, that of a neutral line between two conflicting currents surcharged with debris, we shall find that it may be applied with more consistency in aid of this than of any other hypothesis: for let us again premise that the original run of the Don waters was free into the lake and nearly (as the outlet of the stream still denotes) at right angles with the shore, then they have impinged upon the lake waters at a point opposite the outlet, and under the influence of the prevailing and the most powerful winds have been turned westerly. The neutral line would of course take the same direction, and on it the deposition alike of the debris from the Don, and the drift from Scarborough would take place, until by that deposition the currents would be divided, the neutral line lost, but a base be formed upon which the extension of the peninsula would result in a westerly direction, and by the drift alone. In these suppositions there is nothing inconsistent with the ascertained facts of the case: indeed we find that the surface of the peninsula is composed of a succession of ridges, all starting from the east, in curves adjacent and tangential, or nearly so, to the line of the south shore, but spreading and pointing towards the north-west: an effect clearly of the south-east wind, and proving that much is due to its greater power and prevalence.

Believing, then, that the formation has been and still is, mainly, if not altogether, from the Eastward, we might proceed to discuss the propriety of the measures suggested in view of the preservation of the Bay Channel from further encroachment. But, we have already said that, "if the premises be erroneous, the deduction must be false," and as the application of that law is common to all arguments, it may perhaps be better not to extend the criticism to those practical measures which we are inclined to think have been suggested in the absence of that full knowledge of the local conditions, under which alone works of so important a character can be prudently undertaken. We cannot, however, conclude without briefly expressing our regret, that in such a case (it matters not from whence the evil comes) the Dredge should be referred to as *a permanent necessity*, for in that view it generally has been, still is, and we think, always should be, the dread of an Engineer. Always a costly expedient, in harbour channel works—except as the remover of some standing and purely local obstruction,—the pioneer of a scour,—or of some equally permanent remedial or preventive power,—it is temporary in its results, endless in its application, and accordingly the *dernier resort* of the Engineer. It is often easier and more economical, *always* more satisfactory, to divert a drift than to remove it; and he must be a patient practitioner indeed, who, having dredged a bar, stands by during the deposition of its successor to renew the process.

In the heading to this review, we have named Mr. Tully's "Letter" as being one of the documents recently submitted on the subject; as, however, the consideration of the others has more than covered the ground which it occupies, and as in relation to the formation of the Peninsula, it professes no novelty, we shall refrain from any special notice, and merely express our satisfaction that this question has at length forced itself upon public notice, and attracted even gratuitous enquiry amongst professional men.

Journal of the Society of Arts and of the Institutions in Union.—George Bell, *London.*

This Journal is a record of the proceedings of the Society of Arts and of the Institutions in union with that body. Its objects are so fully and explicitly detailed in the subjoined introduction to the first number, which appeared November 26th 1852, that we cannot do better than transcribe it in full:

"The rapid increase which, during the last few years has taken place in the business of the Society of Arts, has rendered it necessary for the Council to make a complete change in the mode of publishing the Society's weekly proceedings, which have, in fact, hitherto contained little more than a condensed account of the papers read at the weekly meetings, and such routine business as from time to time came before the Society. As, however, from the greatly enlarged range of subjects which at present occupy the attention of the Society, and from the many important inquiries which its members are prosecuting, the mere weekly transactions evidently constitute but a small part of the useful labours of the Society, it has been deemed necessary by the Council, to adopt such changes in the weekly publication of the Society as should render it not merely a record of the proceedings at the Wednesday Evening Meetings, but, in fact, a regular and systematic Journal of the various great and interesting undertakings which the Society is, at present, actively carrying on.

Ever since the Council determined to dis-continue the publication of a yearly volume of Transactions, the want of a Journal has been felt and acknowledged, and it has been evident that the printed weekly proceedings did not sufficiently meet this requiremet, neither serving as a register of the various important subjects brought before the Society, nor yet even as a means of making the members themselves conversant with the numerous investigations and inquiries carried out by the Committees of the Society. In determining to publish an extended weekly journal, the Council are guided by the fact that while such a paper will prove a more satisfactory means of communicating to the members, and also to the public at large, the proceedings of the Standing Committees, of the Colonial and Foreign Committees, and of the Provincial Institutes Committee, it will, at the same time, also become a means of materially assisting those Committees in the various important matters under their consideration. In no department of the Society's labours, will the new Journal be more useful, than in connection with the General Union of Literary, Scientific and Mechanics' Institutes just formed, and which already numbers 225 institutions in all parts of the Empire, including, in the whole, upwards of 90,000 members. It will be obvious that the Journal will supply a medium of communication with the members of these institutions, and will offer facilities in the way of correspondence between them and the Society of Arts, far beyond any mere system of correspondence by letter. This, whilst it will diminish the labour of the Committees of the Society, will, it is hoped, at the same time, greatly increase their power of usefulness.

It is only necessary at present further to state, that the Journal will be conducted by the Secretary, under the immediate control of the Council; that, under proper regulations, its pages will be open to contributions on all subjects connected with the progress of human industry, and the encouragement of arts, manufactures, and commerce and that, as far as may be found to be practicable, it will, in addition to the proceedings of the Society of Arts, and the Institutions in Union with it, contain brief notices of the proceedings of other similar societies, and in general, of all matters of scientific or technical interest. The Council, however, will only consider themselves responsible for as much as is signed by their Secretary by order."

A very numerous list of subjects for Premiums is given in the third and succeeding numbers of the Journal, some of which are both interesting and important to Canada, and will probably elicit information on the topics to which they refer. The Council state that in publishing the List of Subjects for Premiums for the Session of 1852-3, they desire to indicate some of those subjects of inquiry which are considered as peculiarly deserving of attention, and for which therefore they offer premiums. The object of the Society has always been to encourage useful inventions, and communications relating to any department of Arts, Manufactures, or Commerce, are received and always meet with due attention; a premium or other reward being given in those cases where the communication is deemed of sufficient value or importance. In the following List of Subjects, which includes the first division of the Prize List, each article is followed by a brief note intended to explain more in detail, the object proposed in offering the premium:

1. For the discovery in England, or the importation from any of the British Possessions, of Plumbago, or of some other substance which may be used in lieu thereof, equal in quality to that now obtained from Cumberland.

The use of plumbago is greatly on the increase, whilst the supply appears rather to diminish.

2. For the best sample of any new Ornamental Wood, suitable for the manufacture of furniture.

New Zealand has already furnished some excellent specimens of woods, which have been applied successfully for this purpose. The vast, unexplored tracts of Australasia and Canada, give promise, from what we already know of them, that many valuable woods may also be obtained from those quarters.

3. For the importation of not less than one ton of the Galium Tinctorium from Canada.

This root is stated to yield a very fine flesh lake. Although imported into this country many years since, it has not yet become an article of commerce. This may, perhaps, be due to a deficiency in the mechanism for extracting the colour, or possibly to an ignorance as to the value of the root on the part of the natives themselves.

4. For an account of recent American Inventions, having for their object the substitution of mechanical processes for manual labour in the household and domestic arts.

Many of the useful, though apparently unimportant contrivances, in common use in the States, for facilitating, or altogether dispensing with manual labour and attention, might, it is believed, be imported hither with advantage. Even if not applicable to home purposes, they would certainly be of considerable service to emigrants.

5. For the production of Castings in Iron, equal in sharpness and in delicacy of surface to those now imported from Berlin.

It is said, that the great cause of the superiority of Prussian and Swiss fine-art castings, is attributable to some peculiarities in the sand used in forming the moulds.

6. For the best, simplest, and most economic Flour-mill, for the use of Emigrants and Settlers.

The extension of civilization, the subsequent centralization of all manufactures and the division of labour which this has led to, have induced the construction of powerful machinery applicable to the preparation, on a large scale of the food of man. But the simple and primitive methods used by our forefathers, have been altogether overlooked. The production, therefore, of a simple portable, efficient, and inexpensive mill, which shall be capable of grinding and dressing the emigrant's meal, placed as he is in a somewhat similar position, is a point worthy the attention of our mechanists.

SCIENTIFIC INTELLIGENCE.

A Problem Solved.—What to do with the refuse of our alkali works, has long been a perplexity. Not being an article of commerce, it was a "growing evil," but Dr. Glover, we are told, has in some measure solved the difficulty. He saw that, if not of value as cargo,—if ships would not take it away in their holds,—it might be applied externally to their hulls. He has had it converted into a pigment for iron ships, anti-corrosive, and repellant of barnacles and weeds. If the ingenious device should be found to answer, the doctor may be congratulated on having conferred a great boon on our chemical works and our shipping.—*Gateshead Observer.*

Declivity of Rivers.—A very slight declivity suffices to give the running motion to water. Three inches per mile in a smooth, straight channel, gives a velocity of about three miles an hour. The Ganges, which gathers the waters of the Himalaya Mountains, the loftiest in the world, is, at eighteen hundred miles from its mouth, only about eight hundred feet above the level of the sea; that is, about twice the height of St. Paul's Church in London, or the height of Arthur's Seat, near Edinburgh; and to fall these eight hundred feet, in its long course, the water requires more than a month. The great river Magdalena, in South America, running for a thousand miles between two ridges of the Andes, falls only five hundred feet in all that distance. Above the commencement of the thousand miles it is seen descending in rapids and cataracts from the mountains. The gigantic Rio de la Plate has so gentle a descent to the ocean, that in Paraguay, fifteen hundred miles from its mouth, large ships are seen, which have sailed against the current all the way, by the force of the wind alone; that is to say, which, on the beautifully inclined plane of the stream, have been gradually lifted by the soft wind, and even against the current, to an elevation greater than that of our loftiest spires.—*Arnott's Physics.*

Coating Iron with Copper.—A patent has been granted to Theodore G. Bucklin, of Troy, New York, for a new and improved mode of coating iron with copper, which promises to be an invention of no small importance to the arts. It has long been a desideratum to coat iron with some other and less oxidizable metal, in order to render it more durable in exposed situations. It is more essential to have sheet and plate-iron than any other kind covered with copper. For example, sheet-iron covered with copper would be cheaper than tinned iron for roofs of buildings, &c.; and plate-iron, if covered with copper, would be excellent for making steam-boilers so as to prevent incrustations, &c. Cheapness is an important item in the process. If the process is expensive, then it can be of no general benefit, for pure copper would be preferable; if cheap, it is a most important discovery. A method of covering iron with brass, copper, &c., has long been known; but to cover it and make the copper unite with the iron, like tinned iron, has hitherto been considered problematical. The invention of Mr. Bucklin promises to fulfil every condition desired in making copper iron. Cast, malleable, and wrought-iron can be coated with copper by the new process. The process consists in first removing the oxide from the iron to be coated, then covering it with a medium metal which has a great affinity for the iron, and afterwards dipping the iron so prepared into molten copper, which, by the galvanic action of the medium metal, makes the copper intimately combine with the iron, and form a complete coating. The oxide is removed from iron by means of diluted sulphuric acid, in which the castings or sheets are rubbed with sand; after this they are washed and dipped into a solution of the muriate of ammonia dissolved in a suitable vessel, when they are ready for the next process. This consists in dipping the sheets or plates into molten zinc, immediately after they are lifted out of the sal ammoniac solution. The surface of the molten zinc should be covered with dry sal ammoniac, to prevent the evaporation of the metal. The iron is soon covered with a coating of zinc, and forms what is termed galvanized iron. At hand the operator has a crucible or pot containing melted copper covered with some incombustible substance as a wiper, and he at once dips the zinced iron into this, in which it is kept until it ceases to hiss, when it is taken out and found to be covered with a complete and durable coating of copper. By dipping the iron thus coppered into the solution of sal ammoniac, then into the zinc, and the copper—repeating the process—coat upon coat of the copper will be obtained, until acquires any degree of thickness. The black oxide is prevented from forming on the copper by dipping it afterwards in the salammoniac solution, and then washing it in pure water. This process is entirely different from that of Mr. Pomeroy, for which a patent was granted a few years ago. We have seen samples of iron coated by Mr. Bucklin's process, which were very beautiful and well covered. Unless the melted copper was covered with a non-combustible substance, the plates would come out in a very rough state; but the covering acts as a wiper, and the coppered plates come out smooth and well coated. Brass, or any of the copper alloys, can be made to coat the iron, in the same manner as the copper. We hope this new process will be the means of extending the use of sheet-iron, so as to save considerable to the country that is now paid out for tinned sheets. —*Scientific American.*

Manufacture of Gas from Wood.—Two years ago, Dr. Pettenkofer showed by experiment, at a meeting of the Polytechnic Institute of Bavaria, that a very considerable amount of illuminating gas could be disengaged from 2 ozs. of wood. The inventor's process is now in operation at Basle, and is also about to be introduced at Zurich, Stockholm, and Drontheim. The process is said to be far less expensive than the manufacture from fossil coal, and furnishes a gas which is free from sulphuretted hydrogen, and several useful collateral products, as charcoal, wood-tar, and wood-vinegar.—*Central Blatt.*

New Art of Ornamenting Metallic Surfaces.—Numerous as are the inventions or methods which have been applied for the ornamentation of metals within the last few years, we are not aware of any which, for simplicity and beauty, at all equal that recently invented and patented by Mr. R. F. Sturges, of Broad-street, Birmingham. It affords the means of decorating plain surfaces of objects formed of metal, at a reduction of cost which throws all other processes, devised or invented, into the shade, while, at the same time it materially improves their appearance. The invention depends upon the compression of a material between two or more plates of metal in the operation of rolling. It may astonish our readers to learn that the most delicate thread lace, such as is used in ladies' attire, perforated paper, or wire webbing, when passed through a pair of rolls, leaves an impression upon the sheet of metal, corresponding in depth to the compressibility of the material used as a pattern, and the density of the metal upon which the pattern is required to be impressed or indented. In various articles in electro-plate, Britannia metal, &c., such as those used for all ordinary purposes, it is equal to the much more expensive process of decoration by engraving.

Purification of Naphtha and Preparation of Naphthaline.—Mr. Whitesmith (Glasgow), suggests the following method of purifying coal-naphtha, so as to fit it for preserving potassium :—Take a considerable quantity of the best rectified coal-naphtha, and about ten per cent. of concentrated sulphuric acid. Keep them in contact, with frequent agitation, for three or four days. Decant the naphtha, and add fresh acid, repeating the same process several times. The naphtha, which is now of a deep colour, with an acid reaction, and most pungent odour, is distilled very gradually, and neutralized by a current of dry ammoniacal gas passed through it. It is then repeatedly distilled, rejecting the last portions. Thus, it finally appears as an exceedingly mobile limpid fluid, of a pleasant odour, and is perfectly adapted for preserving potassium. To obtain naphthaline, mix common bituminous coal in fine powder with an equal quantity of quick-lime, put the mixture in a small tin-plate still, and heat over the gas furnace for about an hour. On afterwards opening the still, naphthaline will be found deposited inside the head.—*Artizan.*

Canadian Shipping.—In the annual circular issued by Messrs. Tongo & Co., of Liverpool, on the Shipping Trade of 1852, we are glad to notice the subjoined testimony of the progress made by the Quebec Shipbuilders in their highly important brance of Art and Industry :—"We have much pleasure in noticing a marked improvement, both in the model, material and finish of Canadian Ships, the majority of which have been constructed to class six or seven years, and to which a decided preference is given by buyers over the spruce ships, or those classing but four or five years, even at a very increased price. Among those which have arrived within the last eight months, will be found some, as fine models of naval architecture, as ever have been produced, combining in reality, (from having great length of floor and fine ends) both carrying and sailing properties, of no ordinary kind.

Monthly Meteorological Register, at Her Majesty's Magnetical Observatory, Toronto, Canada West.—January, 1853.

Latitude 43 deg. 39.4 min. North. Longitude, 79 deg. 21 min. West. Elevation above Lake Ontario : 108 feet.

Magnet	Day.	Barom. at tem. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Temperature of the air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N	Wind. 6 A.M.	2 P.M.	10 P.M.	S'nw in Inch.	Rain in Inch.
						°	°															
bc	1	29.526	29.684	29.784	29.691	23.2	26.9	21.2	23.17	0.110	0.129	0.110	0.114	85	87	94	88	N	NW b N	NW b N	--	--
b	2	.776	.685			23.4	31.4			.109	.140			84	79			W b S	N E	E b S	--	--
bc	3	.660	.697	.882	.768	26.9	25.4	18.3	22.95	.129	.117	.086	.100	87	84	82	83	NE b N	N b E	N b E	--	--
a	4	.915	.914	.937	.921	11.6	18.3	10.9	14.45	.069	.072	.066	.073	89	70	86	82	N b E	N b W	N N W	--	--
c	5	.903	.792	.656	29.769	7.1	23.3	18.7	16.03	.058	.114	.083	.080	90	88	78	86	N	S W	SW b W	--	--
c	6	.602	.437	.425	.593	25.8	31.2	21.6	27.97	.126	.119	.101	.132	88	84	84	84	SW b W	S W	S S W	--	--
c	7	.482	.615	.705	.637	29.8	38.4	27.2	30.95	.113	.170	.130	.164	87	73	86	84	S W b S	S W b S	S W	--	--
cd	8	.794	.706	.604	.696	24.6	36.0	35.0	31.77	.104	.196	.188	.168	81	93	93	92	NE b N	E b N	E N E	--	0.290
cd	9	.578	.723			35.3	40.9			.197	.178			93	70			S W b W	W S W	Calm.	--	--
c	10	.690	.752	.813	.777	24.1	37.4	32.1	32.33	.113	.177	.171	.165	85	79	91	89	W S W	S S W	S S W	--	Inap
a	11	.895	.954	.976	.948	31.5	33.8	30.7	32.55	.169	.121	.153	.146	85	62	89	79	N b W	N E	N E	--	--
c	12	.973	.922	.928	.938	22.3	24.1	17.7	21.08	.110	.059	.058	.080	88	45	86	75	N E	E N E	N E	0.4	--
c	13	.843	.865	.872	.879	20.2	26.0	23.7	23.47	.100	.084	.116	.105	89	59	88	81	N E	E N E	N E	0.5	--
c	14	.855	.810	.816	.830	23.6	28.0	27.3	26.52	.116	.135	.133	.127	88	87	88	87	N E b N	N b E	N b E	0.4	--
a	15	.731	.676	.809	.752	29.1	31.2	10.1	21.40	.142	.117	.058	.117	88	67	78	79	SW b W	NW b N	NW b N	Inap	--
b	16	.915	.963			-6.6	4.7			.021	.050			65	85			NW b N	NW b N	N N W	--	--
b	17	.910	.807	.637	.784	5.0	18.0	13.9	12.38	.018	.082	.070	.037	81	80	80	80	W b N	N W	N b E	--	--
c	18	.658	.673	.799	.716	11.4	20.2	18.3	17.62	.079	.081	.091	.084	89	72	88	84	N b E	NW b N	N b W	--	--
a	19	.89[illegible]	.890	.839	.859	18.0	21.9	25.9	23.12	.081	.102	.113	.102	82	75	79	80	N W b W	N W b W	SW b W	--	--
ac	20	.694	.462	.528	.557	21.4	32.9	25.8	27.97	.113	.132	.118	.124	84	70	82	79	W S W	SW	W b S	--	--
b	21	.632	.634	.595	.621	18.7	31.1	27.9	25.67	.087	.161	.135	.122	82	81	88	84	W b S	S S W	S S W	--	--
a	22	.523	.428	.324	.411	19.7	37.0	23.7	28.05	.091	.167	.113	.134	85	77	90	85	S S W	S S W	S S W	--	--
b	23	.030	28.788			30.9	31.0			.157	.185			92	95			N N E	E N E	N	4.0	Inap
b	24	28.665	28.850	29.160	28.922	33.2	29.7	19.4	27.08	.167	.112	.077	.120	88	67	71	78	N b W	NW b N	NW b W	2.0	--
b	25	28.889	28.991	29.171	29.036	27.5	13.6	9.7	16.27	.145	.061	.062	.080	96	71	85	8[illegible]	S S W	NW b N	N W	0.2	--
a	26	29.559	29.780	29.876	29.768	-0.3	4.0	7.5	3.72	.035	.016	.014	.012	76	81	66	75	N W	W N W	SW b W	--	--
ac	27	30.059	30.180	30.315	30.187	12.7	19.7	10.5	13.72	.055	.076	.057	.062	79	70	77	75	SW b W	W S W	Calm	--	--
b	28	30.293	30.220	30.136	30.211	10.0	27.9	24.0	18.25	.062	.101	.094	.084	83	67	81	79	N W b W	S W	S W b S	--	--
a	29	30.036	29.630	29.421	29.657	11.1	35.7	33.0	27.47	.074	.170	.171	.140	97	82	91	89	S W b S	S b W	W S W	--	--
c	30	29.496	29.687			35.9	29.5			.146	.091			69	57			NW b W	N W	Calm	--	--
b	31	29.690	29.552	29.823	29.666	22.6	38.6	28.4	31.13	.105	.179	.116	.137	84	77	73	77	Calm.	S b W	E N E	--	--
	M	29.703	29.691	29.727	29.7121	19.88	27.55	21.72	22.98	0.102	0.120	0.107	0.111	86	75	84	82	MPs 5.69	MPs 7.75	MPs 5.83	7.5	0.290

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
2172.69	1911.13	800.84	1064.17

Mean velocity of the wind - - 6.34 miles per hour.
Maximum velocity - - - - - - 25.3 ml's per h'r, from 11 a.m. to noon 25th.
Most windy day - - - - - - 24th : Mean velocity, 13.58 miles per hour.
Least windy day - - - - - - 10th : Mean velocity, 1.40. ditto.
Most windy hour - - - - - - noon: Mean velocity, 8.37 ditto.
Least windy hour - - - - - - 9 p.m. Mean velocity, 5.20 ditto.
Mean diurnal variation - - - 3.17 miles.

The column headed "Magnet" is an attempt to distinguish the character of each day, as regards the frequency or extent of the fluctuations of the Magnetic declination, indicated by the self-registering instruments at Toronto. The classification is, to some extent, arbitrary, and may require future modification, but has been found tolerably definite as far as applied. It is as follows :—

(*a*) A marked absence of Magnetical disturbance.
(*b*) Unimportant movements, not to be called disturbance.
(*c*) Marked disturbance—whether shewn by frequency or amount of deviation from the normal curve—but of no great importance.
(*d*) A greater degree of disturbance—but not of long continuance.
(*e*) Considerable disturbance—lasting more or less the whole day.
(*f*) A Magnetical disturbance of the first class.

The day is reckoned from noon to noon. If two letters are placed, the first applies to the earlier, the latter to the later part of the trace. Although the Declination is particularly referred to, it rarely happens that the same terms are not applicable to the changes of the Horizontal Force also.

Highest Barometer - - 30.315, at 10 P. M., on 27th } Monthly range:
Lowest Barometer - - 28.653, at 4 A.M., on 24th } 1.662 inches.

Highest observed Temp. - 40.9, at 2 P. M., on 9th } Monthly range:
Lowest regist'd Temp. - —9.7, at A.M., on 19th } 50.6
Mean Highest observed Temperature - - 29.01 } Mean daily range:
Mean Registered Minimum - - - - - 14.89 } 14.16
Greatest daily range - - - - - 40.9 from 2 P.M.,on15th to A.M., of 16th.
Warmest day - - 11th - - - Mean Temperature - 32.55 } Difference:
Coldest day - - - 26th - - - Mean Temperature - 3.72 } 28.83

The "Means" are derived from six observations daily, viz., at 6 and 8, A. M., and 2, 4, 10 and 12, P. M.

Comparative Table for January.

Ye'r	Temperature. Mean.	Max.	Min.	Range.	Rain. D'ys	Inches.	Snow. Dy's	Inch.	Wind. Mean Velocity.
	°	°	— °	°					
1840	17.02	40.6	13.8	51.4	4	1.395	11	No Register	Miles.
1841	25.11	41.7	— 4.1	45.8	2	2.150	14		--
1842	27.54	45.8	1.3	44.5	5	2.170	9		--
1843	28.46	54.4	1.5	52.9	6	4.295	12	14.2	--
1844	19.95	45.6	— 7.7	53.3	7	3.005	11	24.9	--
1845	26.26	43.0	— 3.4	46.4	5	imperfect	9	22.7	--
1846	26.14	41.2	0.3	40.9	5	2.335	10	6.0	--
1847	22.88	42.6	— 2.2	44.8	7	2.135	5	7.5	--
1848	27.83	51.5	—12.0	63.5	7	2.245	8	7.1	5.82
1849	18.49	40.1	—15.2	55.3	4	1.175	10	9.2	6.71
1850	29.14	46.3	10.6	35.7	5	1.250	8	5.2	5.80
1851	25.62	43.2	—12.8	56.0	4	1.275	10	7.8	7.69
1852	18.51	37.3	— 7.0	44.3	0	0.000	19	30.9	7.67
1853	22.98	40.9	— 6.6	47.5	1	0.290	6	7.5	6.34
M'n	23.99	43.87	— 5.08	48.95	4.4	1.825	10.1	13.0	6.67

Monthly Meteorological Register, at St. Martin, Isle Jesus, Canada East, January, 1853.

Six Miles West of Montreal.

[BY CHARLES SMALLWOOD, M. D.]

Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—Estimated Height about 30 ft.

Day.	Barom: corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapour.			Humi'y of the Air.			Direction of Wind.			Mean Velocity in Miles per Hour.			Rain in Inch.	Snow in Inch.	Weather, &c.—A cloudy sky is represented by 10; a cloudless sky by 0.			REMARKS.
	6 A. M.	2 P. M.	10 P. M.	6 A. M.	2 P. M.	10 P. M.	6 A. M.	2 P. M.	10 P. M.	6 A. M.	2 P. M.	10 P. M.	6 A. M.	2 P. M.	10 P. M.									
1	29.615	29.711	29.821	9	7	0	.071	.061	.048	1.00	.92	1.00	N E	N	W N W	21.30	7.12	Calm.		9.50	Str. 4.	Clear.	Clear.	
2	.940	.915	.918	1	21	12.5	.018	.086	.096	.95	.64	1.00	N N W	N N W	N E b E	Calm.	Calm.	Calm.			Clear.	Str. 4.	Str. 10.	
3	.915	.845	.922	11	19	15	.097	.103	.108	.93	.82	1.00	N E b E	N E b E	N E b E	0.87	14.27	13.15		2.50	Str. 10.	Snow.	Snow.	
4	.985	.968	.963	2	12	— 5	.052	.061	.060	1.00	.63	1.00	N E b E	N E b E	N b W	13.21	18.17	13.64			Clear.	Clear.	Clear.	
5	.975	.911	.803	—4	11	0	.058	.063	.018	1.00	.67	1.00	N W	W S W	S b E	2.32	0.38	1.22			Str. 10.	Clear.	Str. 10.	
6	.669	.609	.581	19	30	30	.125	.177	.186	1.00	.95	1.00	S S W	S S W	S S W	Calm	5.48	4.28			do.	Cirr.St10	do.	
7	.496	.599	.709	26	38	35	.129	.207	.222	.80	.84	1.00	SW b W	SW b W	S W b W	5.62	3.76	9.00			do.	Str. 10.	Clear.	
8	.891	.909	.812	26	40	27	.161	.219	.167	1.00	.80	1.00	W	E N E	E N E	6.55	5.99	0.50			Cirr. 3.	Clear.	Clear.	
9	.612	.716	.800	21	38	37	.134	.230	.238	1.00	.94	1.00	N E	E N E	W b N	2.10	6.91	2.71			Str 10.	Str. 10.	Clear.	
10	.822	.801	.756	35	37	33	.222	.239	.187	1.00	1.00	.90	W b S	S	S W	2.69	5.81	5.72			Cirr.Str.8	Cirr. K. 4	Cirrstr10	
11	.925	.981	30.018	25	33	12	.118	[illegible]	.090	.95	.90	.94	W b N	W N W	N E	6.43	5.11	5.82			Clear.	Cirr. 4.	Clear.	
12	30.246	0.226	.236	1	10	5	.018	.002	.019	.95	.80	.78	N E b E	N E b E	N E b E	4.25	3.21	4.82			Str. 10.	Clear.	Clear.	Faint Aurora Bor.
13	.191	.105	.056	2	18.5	14	.054	.094	.097	.95	.85	.93	N E b E	N E b E	N E b E	16.12	11.82	8.21			Cirr.St. 4.	Clear.	Clear.	Do. do.
14	.031	29.910	29.811	9	27	19	.071	.129	.110	1.00	.80	.88	N E b E	N E b E	NW b W	11.33	4.77	0.10			li'gt cir. 4	Str. 9.	Str. 10.	
15	29.684	.652	.605	20	29	16	.129	.170	.098	1.00	.91	.88	N W	N W	N W	1.01	2.11	15.40		Inap.	sl'gt snw	sli'gtsnw	Str. 10.	
16	.680	.696	.641	—2	2	1	.037	.042	.050	.85	.76	1.00	W N W	W N W	W N W	[illegible]	14.62	13.63			Str. 10.	Str. 10.	Str. 10	
17	.787	.807	.828	0	13.5	2	.018	.065	.053	1.00	.70	1.00	W	W S W	W S W	17.28	9.13	4.49			Str. 10	Clear.	Clear.	
18	.827	.712	.820	4	21	12	.050	.101	.076	.95	.67	.93	N N E	N E b E	NW b W	0.97	Calm.	Calm.		0.86	Snow.	Snow.	Str. 10.	
19	.875	.840	.835	12	21	17	.090	.121	.116	1.00	.80	1.00	W N W	W b S	W b S	Calm.	3.00	3.74		Inap.	Str. 10.	Cirr.Str.4	Str. 10.	
20	.701	.543	.617	16	31	18.5	.087	.162	.122	.78	.75	1.00	W N W	W S W	W S W	Calm	7.50	0.90			Str. 10.	Clear.	Str. 10.	
21	.645	.618	.612	21	40	25	.134	.219	.155	1.00	.80	1.00	W N W	W S W	SW b W	2.70	6.88	6.07			Str. 10.	Cirr.Str.4	Clear.	
22	.537	.502	.172	25	42	33	.155	.240	.207	1.00	.82	1.00	S S W	SW b W	S W b W	8.58	8.37	4.36			Str. 8.	Str. 4.	Str. 10.	
23	.315	.167	28.898	25	31 5	[illegible]	.155	.203	.192	1.00	.91	1.00	N E b E	N E b E	N E b E	1.46	2.50	11.90		4.50	Cirr. 3.	Sleet.	Snow.	
24	28.635	28.720	.950	28	28	19	.175	.163	.125	1.00	.91	1.00	N N E	W N W	W N W	25.09	4.35	7.27		2.60	Str. 10.	Snow.	Cirr.Str.4	
25	29.191	29.181	29.250	— 5	—3.7	— 1	.027	.010	.013	.68	.96	.95	N N E	E N E	W	8.55	10.44	11.61		3.00	Clear.	Snow.	Cirr.Str.5	
26	.542	.636	.968	—13	— 3	—18	.027	.029	.026	1.00	.68	.98	W N W	W	W b N	7.73	5.25	14.56			Clear.	Clear.	Clear.	
27	30.149	30.213	30.336	—28	— 4	—19	.012	.029	.020	1.00	.68	1.00	N N E	E b N	N E b E	Calm.	0.88	0.12			Cirr. 3.	Cirr. 2.	Clear.	
28	.382	.210	.185	—12	18	6 5	.021	.101	.063	.75	.94	1.00	N N W	W S W	S W b W	1.19	0.42	Calm.			Str. 10.	Clear.	Clear.	
29	.090	29.978	29.521	— 3	33	21	.012	.187	.116	1.00	.90	1.00	SW b W	S S W	S S W	1.77	0.96	Calm.			Clear.	Clear.	Str. 10.	Zodiacal Li't bri't
30	29.376	.600	.715	27	20	11	.140	.114	.075	.88	.87	.72	W N W	W N W	W N W	3.33	16.66	18.08			Clear.	Str. 4.	Str. W.	& well defined f'm
31	.775	.760	.919	7	22.5	—1.5	.061	.092	.039	.92	.65	1.00	E N E	N W	N W	8.01	2.06	0.87		0.40	Str. 10.	Str. 4.	Clear.	sunset till 8 p. m.

Barometer.
- Highest the 28th day - - - - - - 30.382
- Lowest the 24th day - - - - - - 28.635
- Monthly Mean - - - - - - 29.757
- " Range - - - - - - 1.747

Thermometer.
- Highest the 22nd day - - - - - 42.0
- Lowest the 27th day - - - - - —28.7
- Monthly Mean - - - - - - 16.68
- " Range - - - - - - - 70.7

Most prevalent Wind—the N. E. by E.

Least do. do. —S.

Most Windy Day—the 16th day.

Mean miles per hour—15.28.

Least do. do. —the 2nd day.

Mean Miles per Hour—Inapp.

Snow fell on 9 days, amounting to 23.36 inches.

Rain fell on 0 days.

Greatest intensity of the Sun's Rays—61.0.

Mean of Humidity—.909.

Aurora Borealis visible at Observation: Horizon—2nd night.

The Electrical state of the Atmosphere has been marked during the month, *generally* by feeble *positive* intensity, except on the 16th and 25th days, when it indicated very high Intensity of *Positive* with "spirtings" of *Negative* Electricity.

On the Preparation of Liquid Glue.—All chemists are aware, that when a solution of glue (gelatine) is heated and cooled several times in contact with the air, it loses the property of forming a jelly. M. Gmelin observed that a solution of isinglass, enclosed in a sealed glass tube and kept in a state of ebullition on the water-bath for several days, presented the same phenomenon—that is to say, the glue remained fluid, and did not form a jelly. The change thus produced is one of the problems most difficult of solution in organic chemistry. It may be supposed, however, that, in the alteration which the glue undergoes, the oxygen of the air or of the water plays a principal part; what leads me to think this, is the effect produced upon glue by a small quantity of nitric acid. It is well known that by treating gelatine with an excess of this acid, it is converted by heat into malic and oxalic acids, fatty matter, tannin, &c. But it is not thus when the glue is treated with its weight of water and with a small quantity of nitric acid; by this means a glue is obtained which preserves nearly all its primitive qualities, but which has no longer the power of forming a jelly. Upon this process, which I communicated, is founded the Parisian manufacture of the glue which is sold in France under the title of "*colle liquide et inaltérable*" This glue being very convenient to cabinet-makers, joiners, pasteboard-workers, toy-makers, and others, as it is applied cold, I think it my duty, in order to increase its manufacture, to publish the process:—It consists in taking 1 kilog. of glue, and dissolving it in 1 litre of water in a glazed pot over a gentle fire, or, what is better, in the water-bath, stirring it from time to time. When all the glue is melted, 200 grms. of nitric acid (spec. grav. 1·32) are to be poured in, in small quantities at a time. This addition produces an effervescence, owing to the disengagement of hyponitrous acid. When all the acid is added, the vessel is to be taken from the fire, and left to cool. I have kept the glue, thus prepared in an open vessel during more than two years, without its undergoing any change. It is very convenient in chemical operations; I use it with advantage in my laboratory for the preservation of various gases, by covering strips of linen with it.—M. S. Dumoulin: *Comptes Rendus*, Sept. 27.

On the composition and microscopic structure of certain Basaltic and Metamorphic Rocks, by DR. ANDREWS.—By examining a thin splinter of basalt under the microscope, Dr. Andrews has succeeded in detecting the presence of the following minerals: 1st, a colourless glassy mineral, probably some variety of Zeolite; 2nd, Augite; 3rd, Magnetic oxide iron; 4th, Iron Pyrites. By examining the metamorphic rock of Portrush, an indurated clay containing the characteristic fossils of the lias formation, an immense number of very minute crystals of iron pyrites were discovered, and on reducing it to powder and touching with a magnet, a quantity of magnetic oxide of iron was extracted. This mineral seems to be much more universally diffused than is generally supposed, it having been detected by Dr. Andrews, in various specimens of basalt, granite, primitive limestone, hardened chalk, magnesian limestone, and many metamorphic rocks. In roofing slate, serpentine and marble, only a doubtful trace could be detected.

Dr. Andrews has also succeeded in detecting the presence of metallic iron in various basalts. Pure or uncombined iron exists in meteoric stones, which are very similar in many respects to basalt, but the instances of its having been found as a mineral, are very few, and not in every case well authenticated. The grains of iron in the Uralian gold and platinum sands, have been proved by Rose, to arrive from the iron vessels employed in the washing, and Dr. Andrews expreses some doubt as to the iron of Canaan, in Connecticut. The method of detecting the metallic iron, is to reduce the mineral to powder, to extract the magnetic particles by means of a magnet, and having brought them into the field of the microscope, to moisten them with an acid solution of sulphate of copper; a deposit of red metallic copper then takes place. If dilute sulphuric acid be employed alone, an effervescence will be observed from various points, which ceases immediately on the addition of the copper solution, a red precipitation being produced. Dr. Andrews has selected the iron in several basalts, in the indurated lias slate of Portrush, and in the trachyte of Auvergne.

The effect might possibly be produced by nickel and cobalt, instead of iron, but the presence of either of these metals, is exceedingly improbable. Dr. Andrews seems inclined to ascribe the origin of the metallic iron, to the reducing agency of such gases as hydrogen or carbonic oxide, while the basaltic rock was still in a state of ignition.—*British Association, Belfast, Sept 2nd*, 1852.

Mr. Lettsom has also discovered the presence of metallic iron in fossil wood.—*Philosophical Magazine, November*, 1852.

CANADIAN INSTITUTE.

ANNUAL CONVERSAZIONE.—NOTICE TO COUNTRY MEMBERS.

On Saturday, March 26th, the Annual Conversazione of the Canadian Institute will be held in the Hall of the Legislative Assembly, Toronto.

It is confidently anticipated, that before the close of the present Session, the number of Members of the Institute will exceed three hundred; and as there are many country members residing within a few miles of the city of Toronto who may wish to attend the Annual Conversazione, we take this early opportunity of announcing the day on which it will take place.

OBITUARY.

DEATH OF SEARS C. WALKER.—The death of this eminent mathematician and astronomer took place on the 30th of January, at the residence of his brother, Judge Walker, at East Walnut Hills, near Cincinnati. Mr. Walker was born at Wilmington, Mass., in 1805; graduated at Cambridge in 1825. After his graduation at Cambridge, he constantly devoted, as an amateur, much of his time to his favourite science, but for some years past he was connected with the Coast Survey.

About eighteen months ago he was attacked, in this vicinity, by severe illness, from which, although induced by his zeal to attempt to resume his scientific labours, he never, but partially, recovered.

The researches of Mr. Walker, especially those respecting the motions and the elements of the planet Neptune, gained him a high reputation in Europe, and some years since the Royal Astronomical Society of London elected him a member.

Mr. Walker, as a theoretical and practical astronomer, was equalled by few, and probably not excelled by any one in the United States.

DEATH OF GREAT GRAND-CHILDREN OF BURNS.—We find the following melancholy announcement in the *Dumfries Courier* of Tuesday last:—"Died, at sea, on board the ship Chance, from Liverpool to Port Philip, on the 7th of September last, Arabella Ann; on the 8th September, Robert Burns; on the 18th September, Arthur Vincent, the only children of Mr. Berkeley W. Hutchinson, surgeon, government medical officer of the Chance, and great grand children of Robert Burns." Mrs. Hutchinson is the daughter of Major James Glencairn Burns, and was educated in Dumfries, under the care of her grandmother, "Bonnie Jean."

THE CANADIAN JOURNAL

Will be published Monthly, and furnished to Subscribers for 15s. per annum, in advance. To Members of the Canadian Institute the *Journal* will be transmitted without charge.

Persons desirous of being admitted into the Institute, as Members, are requested to communicate with the Secretary. The Entrance Fee (including one year's subscription,) is One Pound Currency.

There are three classes of persons who may with propriety join the Institute. First—Those who by their attainments, researches, or discoveries, can promote its objects by their union of labour, the weight of their support, and the aid of their experience. Second—Those who may reasonably expect to derive some share of instruction from the publication of its proceedings by the *Journal*; and an acquaintance with the improvement in Art and the rapid progress of Science in all countries,—a marked feature of the present generation. Third—Those who, although they may neither have time nor opportunity of contributing much information, may yet have an ardent desire to countenance a laudable and, to say the least, a patriotic undertaking,—a wish to encourage a Society where men of all shades of religion or politics may meet on the same friendly grounds: nothing more being required of the Members of the CANADIAN INSTITUTE than the means, the opportunity, or the disposition to promote those pursuits which are calculated to refine and exalt a people.

All communications relating to the CANADIAN INSTITUTE to be addressed to the Secretary. All communications connected with the *Journal* to be addressed to the Editor. Remittances on account of the *Journal* received by the Treasurer of the CANADIAN INSTITUTE.